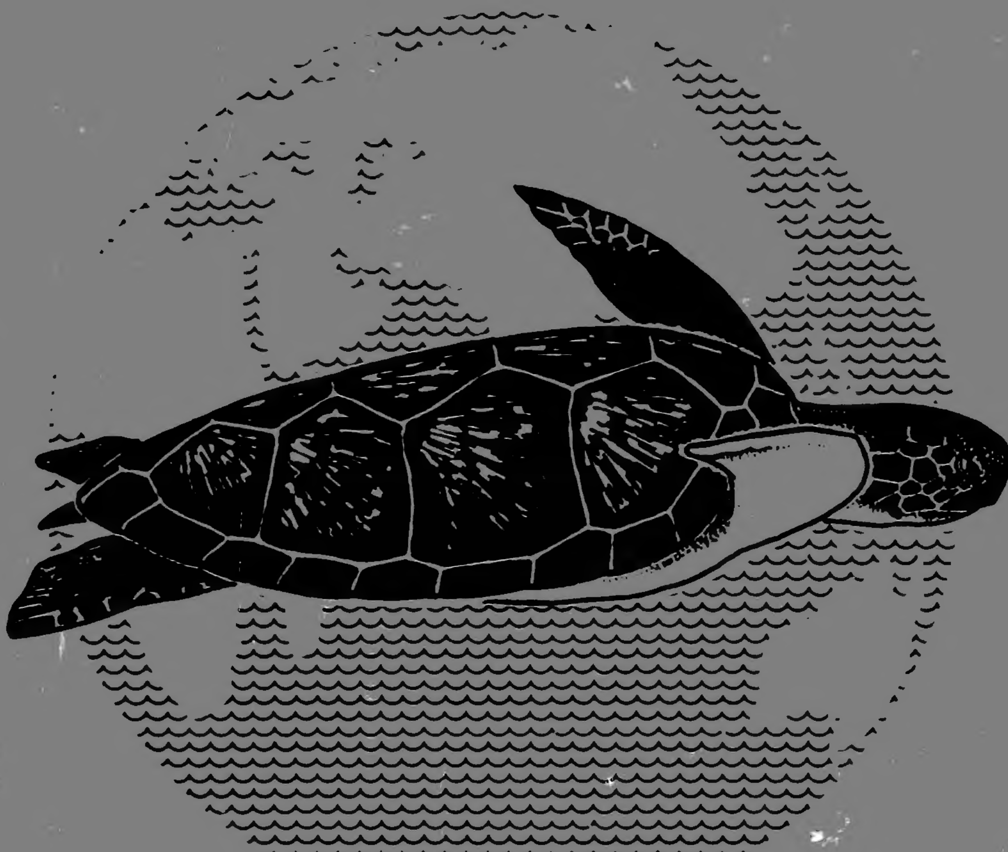
The green turtle and hawksbill (Reptilia: Cheloniidae): world status, exploitation and trade



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United Nations Environment Programme

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SUMMARY

1. Recent investigations into the systematics of sea turtles are few; the present sub-generic taxonomy is unsatisfactory, and unlikely adequately to reflect between-population genetic variation.

2. It is difficult to estimate population size and trends in sea turtles. Although some feeding ground aggregations have been studied, it is only possible to assess population size by means of an estimate of the number of mature females that emerge on a given nesting beach. Because females typically nest on two- to three-year cycles, the annual nesting contingent will be a minor proportion of the total adult female population. Because massive fluctuation in annual nesting numbers has been demonstrated at several sites, population trends can only reliably be distinguished as a result of long-term field studies. Hawksbill numbers are particularly difficult to assess because females tend to nest singly or in small numbers, often on small unsurveyed beaches.

3. Virtually all reported between-season recoveries of nesting females tagged on their nest beach have occurred on the same beach (most data relate to C. mydas, the subject of most tagging operations). This precise homing has led to the prevailing view that nesting beach populations are isolated genetically from one another. There is evidence for very occasional dispersal of females to different nest sites, and for sufficient flexibility to allow slow colonisation of new nesting sites. Significant gene flow must occur if turtles do not nest on their own natal beach. However, no extirpated nesting population has been seen to be replenished by other populations, and the precise homing that has been shown to occur among mature animals nesting in their second or subsequent season means that each nest site population must be treated separately for conservation and management purposes.

4. Growth rates are likely to be partly dependent on food supply, but the available data show that maturation in C. mydas is attained after a long period of between 20 and 50 years; present indications are that E. imbricata may be similar, although a higher growth rate has been demonstrated at one site holding both species. The practical importance of late maturation is that the effects of human interference with wild populations, whether adverse or beneficial, can be masked for many years. Over-exploitation may not be evident because it would theoretically be possible to take every egg or adult from a nest beach for some 20 years with little obvious effect, as newly maturing females would still emerge to nest during this period; but the population would then crash because recruitment had ceased some 20 years in the past.

5. Eggs of all sea turtle species are widely collected for direct subsistence or medicinal use, or for sale, usually locally or nationally. Turtle oil is used for fuel, as a lubricant and waterproofing agent, and for medicinal and cosmetic purposes. Green Turtle meat and cartilage are widely consumed for subsistence purposes, and, as ingredients of 'turtle soup', as a luxury foodstuff in international trade. Between 40% and 50% of the wet weight of a Green Turtle comprises edible protein; a sub-adult or adult individual might weigh in the region of 100 kg. Hawksbill meat is consumed less regularly, and is sometimes highly poisonous. Hawksbills are used mainly for their shell, known as "tortoiseshell"; the shell of Green Turtles is too thin for carving and is rarely traded. A market has been created in the last few decades for turtle skin; Olive Ridley Lepidochelys olivacea is

the main source but some Green Turtle skins are traded. Immatures and sub-adults, particularly Hawksbills, are frequently traded as curios, stuffed and varnished.

6. Historically, the international trade in Green Turtle meat developed between European countries and their colonies in the tropics. An estimated 15 000 Green Turtles were imported into England in one year in the late 19th century, and very large numbers were taken during the 20th century, mainly from the Caribbean and the western Indian Ocean. There is little evidence for continuing international trade in Green Turtle meat; this can be attributed largely to effective implementation of CITES. Some meat has been exported from Cayman Turtle Farm and from the ranch on Réunion. Domestic trade is very extensive in some countries (e.g. Indonesia and Mexico) and is causing serious decline in Green Turtle populations.

7. A market for tortoiseshell derived from the carapace and marginal scutes of Eretmochelys ("bekko" in the Japanese trade) has existed for many centuries. A single turtle yields between 0.75 and 1.5 kg of tortoiseshell in the form of 13 carapace scutes, with an average of around 1 kg; the 27 small marginal scales are less in demand. After a brief period of decline in demand owing to the introduction of plastic substitutes, demand has been very high in recent decades. Japan is the destination of most raw tortoiseshell in international trade, although the Republic of Korea and Taiwan are also major importers. Customs data indicate that in 1986 Japan imported shell from around 26 000 large Hawksbills, and about 8 000 smaller stuffed Hawksbill. The American and European trade is now insignificant in comparison, although some tortoiseshell is still used in France and F.R. Germany.

8. Mortality is highest in eggs and hatchlings and lowest in adults; larger sub-adults and adults are of greatest reproductive value to the population and exploitation of these classes, together with juveniles, must be avoided whenever possible. Regular exploitation of adult females on the nest beach, and of adults in inter-nesting habitat, can lead to severe and rapid decline in the nesting contingent of the target population (e.g. C. mydas in Pacific Mexico); egg harvesting has a less rapid effect on population size, but wherever good long-term records are available (e.g. Burma, Sarawak) continual intense egg harvesting has been shown to lead to severe population decline, albeit over decades rather than years. Exploitation of turtles on feeding grounds will affect both sexes and various age classes, and in principle, if practised in moderation, would be expected to constitute a less acute threat to turtle populations than nest beach exploitation. However, tracing the causal connection between turtle numbers on the nesting beach and turtle harvest on distant foraging grounds is difficult; where such harvesting is intense serious concern is justifiable (e.g. Indonesia, where there is much evidence of population decline).

9. It is likely that the type of low-intensity exploitation of Green Turtle that was in the past practised in remote places by certain littoral peoples (e.g. the Seri and Nahuatl in Mexico) is ever less likely to persist at low intensity. Any restraint that was exercised was probably due not to an intuitive understanding of turtle population dynamics, but to low human density, technological limitations to the processes of turtle harvesting, transport and storage, and limited opportunity for trading. There are now many more people inhabiting tropical coasts than there were at the turn of the century; more beaches and foraging grounds are easily accessible due to the construction of roads; fishing communities have aluminium boats,

outboard motors, nylon nets, and the incentives of a cash economy, but no intrinsic and overriding interest in exercising restraint. Similar factors apply to the Hawksbill, although the historic use of tortoiseshell must have led to significant pressure on certain populations, greatest at first on those within reach of classical civilisations, and later those within the trade networks of colonial Europe and North America. Whilst the sparsity of nesting and present general rarity might be expected to hinder further excess harvest, these factors are countered by the continuing strong demand for tortoiseshell and the widespread collection of eggs.

10. No closed-cycle captive breeding of sea turtles has yet occurred, insofar as no turtle conceived in captivity has yet produced a second generation in captive conditions. Ranching, in the sense of rearing in captivity eggs or young turtles taken from the wild, is technically feasible, but unless strictly controlled, carries a risk of depleting local turtle populations. It is also feared that the resulting trade may stimulate the illegal trade in turtle products.

11. Exploitation, whether for local subsistence use or international trade, demonstrably has the potential seriously to affect turtle populations. Review of the status of Green Turtle and Hawksbill populations suggests that substantial turtle populations will be able to persist only where there is no tradition of exploitation, or where the infrastructure exists to enforce restrictions on exploitation or the protection of nesting beaches and foraging grounds.

12. The Green Turtle <u>Chelonia mydas</u> (<u>sensu lato</u>) is a very widespread species, distributed in more than 80 countries in the tropics and subtropics, many with a large number of nesting colonies. A great many female Green Turtles, on average probably between 100 000 and 200 000, nest each season; however, most existing significant nesting populations are either known or suspected to be depleted or in decline. Decline is well-documented in a minority of cases, but it can be assumed that utilisation practices which have been shown to deplete certain populations will have similar effects on other populations, although historical evidence of decline may be lacking. Seven nesting aggregations are known to have been extirpated, virtually all of these were island populations which disappeared after human colonisation.

13. The Hawksbill <u>Eretmochelys imbricata</u> is a very widespread species, known to nest in at least 60 countries in the tropics and subtropics, but suspected to nest in more. Available information is incomplete, but it appears that a minimum of between 15 000 and 25 000 females nest annually; no quantitative data are available for many known and suspected nest sites. The world Hawksbill population appears to be far smaller numerically than that of the Green Turtle complex. It is possible that the former has always been less abundant globally than the latter, but it can be inferred that the relative rarity of the Hawksbill is largely a result of prolonged over-exploitation for eggs and the international tortoiseshell trade. Around half of the known nesting populations are known or suspected to be in decline; in particular, the entire Western Atlantic-Caribbean region is greatly depleted. Decline is well-substantiated at relatively few sites, but can reasonably be inferred at many others; for many areas, trends are unknown.

14. For both Green Turtle and Hawksbill, in virtually every case where decline is known or suspected, exploitation is established or implicated as

a primary cause. Many populations of both species are in addition threatened by marine pollution, incidental catch and beach development, either alone or in combination; the relative importance of each factor varies geographically.

15. There are marked difficulties involved in attempting to apply current IUCN status categories to marine turtles. Aspects of their population biology mean that it is difficult to obtain the hard evidence needed to attribute categories accurately, and suggest that individual or regional populations should be separately categorised, protected and managed. It is clear that existing management action and legislation applied to the Green Turtle and the Hawksbill not only must be maintained, but frequently require improvement or more effective implementation.

16. Both the Green Turtle and the Hawksbill are currently listed on Appendix I of CITES. It is indisputable that both are significantly threatened and that international trade has been a primary cause of population decline and remains a serious threat. The present Appendix I listing of <u>Chelonia mydas</u> (which must be understood to include East Pacific populations often called <u>C. agassizii</u>) and <u>Eretmochelys imbricata</u> is unquestionably appropriate and must be maintained.

SCOPE AND METHODS

The present study was undertaken by the IUCN Conservation Monitoring Centre, under contract to the Secretariat of CITES, primarily between 1 July 1986 and 30 April 1987. A draft report was submitted to the CITES Secretariat in July 1987. The draft was revised following review, and new data that became available up to 1 November 1988 were incorporated.

The primary objectives of the project were as follows:

(i) To collect and collate the best available data relating to the status and distribution of significant populations of Chelonia mydas and Eretmochelys imbricata, assess trends in the size of each such population, and identify the reasons for such trends where possible.

(ii) To examine the best available data relating to the trade in the two species, including their parts and derivatives, and so far as possible assess the impact of such trade on populations.

(iii) To make recommendations for consideration by CITES Parties for each population, relating to its overall management, to endeavour to ensure its continuance at an optimum level, and to the extent to which any exploitation by farming, ranching or culling is consistent with such management.

The third objective listed above not only touches on a number of highly controversial topics, but is in fact impossible to meet with the degree of precision that would be desirable. This arises in part from a lack of detailed information on population numbers and trends (this applies to many C. mydas populations and to E. imbricata almost throughout its range), and in part from the still poorly-known pattern of sea turtle population dynamics.

There are insurmountable difficulties involved in attempting to develop firm and quantified management procedures for an animal that mainly and most predictably enters mankind's perception of the world only while on the nesting beach; and this involves only one sex, one age group of that sex, and a virtually unknown proportion of that age group (in other words, the mature females that are reproductively active in any given season). Clearly, management of sea turtles will bear little resemblance to management of, for example, terrestrial ungulates, where in some cases virtually the entire local population can be enumerated, aged, sexed, and the reproductive value of individual animals assessed. Given these practical limitations, the management recommendations that can be made are general principles, based on the facts of turtle biology and what is known of the effects of exploitation on turtle populations, not population-specific management programmes based on a detailed assessment of individual turtle stocks.

A questionnaire designed to elicit basic information, and to apprise us of recent research, was circulated to the Management Authorities of all states Party to CITES and to a number of other individuals. Particular issues were pursued by more detailed correspondence, and by literature search. All trade in Chelonia mydas, Eretmochelys imbricata or Cheloniidae recorded in CITES Annual Reports between 1977 and 1985 (reports received before March 1987) was analysed and trade in turtle products recorded in published Customs statistics was also considered.

We have made a particular effort to gather data on Indonesia and Réunion (and the Iles Eparses), these areas being of particular relevance to the present study by virtue of their importance to turtle populations and the current or planned existence of turtle ranching schemes. We were fortunate in securing the services of Joop Schulz as a consultant in Indonesia; his programme (which took place between 24 January and 14 March 1987) was intended to fill some of the more important gaps in knowledge identified in his earlier report (Schulz, 1985), with particular emphasis on population status and the current situation in regard to trade and its control. In addition to much correspondence with sea turtle biologists concerned with turtle stocks in the region and with the Réunion ranch, one of us (Luxmoore) visited Réunion and Tromelin 18-25 January 1987. We also commissioned Peter C.H. Pritchard to visit New Caledonia (late February 1987) and provide a report on sea turtle populations and conservation, and J. and S.S. Frazier to provide a report based on recent research in the Maldives including a questionnaire project carried out jointly with the Ministry of Fisheries. One of us (Groombridge) visited nest sites in Pakistan and made a brief survey of nest beaches in Baluchistan, supplemented by an aerial survey in September 1988. The Centre for Environmental Education (Washington DC) funded TRAFFIC Japan (T. Milliken and H. Tokunaga) to prepare a report on recent Japanese trade in sea turtle products which was to be used as a supplementary source of information for this project.

These visits and consultancies were selected from an informal list of priority projects, the main criteria for final selection being the availability of suitable personnel and the feasibility of making the necessary arrangements within the very short time available to us. We had hoped to carry out a survey of the Somalia coast, which, with parts of Indonesia, Western Australia, Yemen (PDR) and the Gulf of Guinea Islands, remains one of the few poorly known turtle areas thought to hold large populations; unfortunately, this proved impossible, and such a survey remains one of the most pressing research needs.

Given the emphasis on the interrelation of status, utilisation and trade, embodied in the objective of the project, we have been able to devote only little attention to certain other important factors that can exert an effect on turtle populations; thus only peripheral mention is made of beach development, pollution and incidental catch, and we have not attempted to cover these topics consistently in the country accounts.

The country accounts generally include only those countries where at least one of the two species of concern is known to nest, or where there is reason to suspect they may do so. A few countries, Singapore and Taiwan, for example, are included because of their significance in international trade in turtle products, although no nesting is known. Several countries (Greece, for example) are excluded even though one or other species (C. mydas, in this case) may have been recorded on occasion in their territorial waters.

The July 1987 draft of this report was amplified during 1988 by select new or previously unavailable data; material received after 1 November 1988 was not included, and we have not been able systematically to scan all literature that appeared after completion of the first draft. Relevant sections of the first draft of this report were circulated to members of the IUCN Marine Turtle Specialist Group for expert review. We have incorporated all observational data and other factual material as necessary, and so far as matters of interpretation or opinion are concerned, have attempted

impartially to represent differing points of view. We stress, however, that all opinions expressed herein are those of the authors alone, and do not necessarily reflect the views of those who have contributed material.

MARINE TURTLE SYSTEMATICS

Species, individually or as communities, are the typical target for conservation and management action, and the maintenance of maximum species diversity is a fundamental, if often unspoken, goal (although many would emphasise genetic diversity, not necessarily at the species level). Although most taxonomists, and biologists in general, would probably define a species along traditional lines (a group of interbreeding natural populations that are reproductively isolated from other such groups), in everyday taxonomic practice the degree of reproductive isolation generally is inferred from the degree of morphological difference between the samples at hand. It has often been the case that very few morphological characters are considered, frequently those most superficially obvious and most susceptible to enumeration.

In the examples of reptile systematics investigated by Thorpe (1980, 1984), and by implication in reptile systematics generally, the view of population differentiation derived by conventional procedures, by simple inspection of a few superficial characters (of colour and lepidosis), compared very unfavourably with that derived from multivariate analysis, employing a great many characters. Thorpe (1980) concluded "It is apparent that the conventional procedure of naming subspecies does not take into account the appropriate evolutionary facts and in practice does not refer to any abstracted levels of divergence necessary for subspecific recognition. Consequently, a large number of meaningless subspecies are erected which obscure the patterns of population differentiation..."

Similar limitations are evident in sea turtle systematics, and in view of the intense conservation attention that has been paid to the group, it is unfortunate that their specific and infra-specific taxonomy remains unsatisfactory in several respects. This is presumably attributable largely to the paucity of taxonomic characters that have been employed, the lack of sophisticated methods of analysis, and in part to the lack of information on breeding systems and behaviour. These factors are exemplified by the systematics of the Green Turtle *Chelonia mydas* (*sensu lato*).

For much of the past hundred years the genus *Chelonia* had been treated as comprising the single species *C. mydas*. The north Australian form *C. depressa* (the Flatback), although initially described as a full species in 1880, was not widely recognised as distinct from *mydas* until its formal re-description, after thorough discussion, in the late 1960s (Williams *et al.*, 1967); the species has recently been moved from the genus *Chelonia* to the monotypic genus *Natator* (Limpus *et al.*, 1988).

The remaining forms of *Chelonia* were generally regarded as comprising the single species *C. mydas*, often with two distinct subspecies recognised: *C. m. agassizii* Bocourt, 1868 in the eastern Pacific (according to Carr, 1975, from Baja California south to Peru and west to the Galapagos, Hawaii and the Marshall Islands), and the nominate *C. m. mydas* (Linnaeus, 1758) in the rest of the range. Carr (1975), however, recommended use of *C. m. japonica* (Thunberg, 1787) for Indian Ocean and western tropical Pacific forms, and suggested that Caribbean populations might eventually be

shown to deserve formal recognition as C. m. viridis (Schneider, 1783). All these four subspecific names were originally first employed as specific epithets.

The strikingly dark Gulf of California population was formally described as a discrete subspecies C. m. carrinegra by Caldwell in 1962, but again, this name has not been widely used, and the differences between carrinegra and agassizii (the latter taxon founded on turtles from the Pacific coast of Guatemala) have not been explored or defined. Many, such as Cliffton et al., (1982), Pritchard (1979), Pritchard and Trebbau (1984), appear to use the latter name for all coastal Pacific populations (including the Galapagos).

Pritchard (1979:684) noted that the only group of populations whose differentiation as a distinct subspecies has been universally accepted is the East Pacific C. m. agassizii (contrary to Carr (1975), Pritchard does not include Hawaii and the Marshall Islands in the range of this taxon). Turtles nesting along the East Pacific mainland, and to a lesser degree those in the Galapagos, do indeed differ from other forms of mydas in size, colour and carapace shape. Pritchard (1983: 110) also noted occasional apparent sympatry between agassizii and mydas forms, and cites this as evidence for species-level differentiation of agassizii. Whether such cases simply represent the chance encounter of individuals from relatively distinct populations in what is primarily a foraging area for one or both individuals, or actual failure to interbreed given that both are in the physiological condition to do so, has not been determined.

Although Bocourt originally described agassizii as a full species back in 1868, this usage has never gained general acceptance, particularly in the present century (when the systematic practices of the last century are often regarded as cavalier and unsophisticated). However, there has been a growing tendency in recent years for this population again to be treated as having specific rank, as C. agassizii (East Pacific or Black Turtle). This may well be justified; the morphological differences of these turtles may well be based on reproductive isolation, but there has never been a thorough, published discussion of this matter, with a formal taxonomic re-description, set in the context of the overall systematics of the C. mydas group.

Curiously, results of one of the first, and still one of the very few, attempts to use biochemical indicators of genetic diversity in sea turtles (an analysis of the amino acid composition of shell keratins) suggested a different conclusion. Hendrickson (1979:24) found the Gulf of California population (viz. C. m. carrinegra Caldwell, 1962) to be "by far the most distinctive" of the eight geographic groups studied, which included "true" agassizii from Oaxaca in Mexico. It was the only form showing "multiple diagnostic differences from all other populations". Further, "This striking amount of differentiation constitutes strong support for the observed morphological and physiological differences between this population and the rest of the green turtles." Hendrickson later (1980:601) stated that C. m. carrinegra Caldwell should be elevated to full species status; it should be noted that Hendrickson explicitly (in 1979 at least) uses this name for the Gulf of California population. In other words, this is not a case for the use of agassizii at species level for all Pacific American "green turtles", and Pritchard (1983) was incorrect in stating that Hendrickson (1980) had presented persuasive arguments for the recognition of C. agassizii - the argument was for carrinegra.

Hendrickson's samples of agassizii were not so comprehensively different from the majority as carrinegra; they differed more from carrinegra than from animals on the eastern side of the Central American isthmus, and they differed most from Hawaiian and Indian Ocean samples (it should be noted that Carr, 1975, at one time assigned Hawaiian animals to agassizii on the basis of frequency of appearance of elements of the agassizii phenotype).

It is difficult to understand how the amino acid differences demonstrated by Hendrickson could have come about, unless there is rather effective reproductive isolation between the two populations nesting on different parts of the coast of Pacific Mexico. There is no evidence available that the Gulf of California carrinegra breed in the immediate vicinity of the Gulf; it appears to be a foraging ground for turtles that nest in Michoacan, and perhaps elsewhere, in southern Mexico. If the differences demonstrated by Hendrickson are indicative of full speciation, then the East Pacific area might hold one endemic species ("agassizii"), and Pacific Mexico alone would hold another ("carrinegra").

The point of this discussion is simply to emphasise that current knowledge of the systematics of the C. mydas complex is grossly inadequate for the formulation of efficient conservation and management plans. How can genetic diversity efficiently be maintained if the distribution of that diversity through sea turtle population groups is unknown? Further study of the systematics of sea turtles, and the development of an optimum taxonomy, is thus of great importance to sea turtle management. New multivariate analysis of morphological differences between geographic samples, coupled with further biochemical analyses (some recent studies are noted in the section "Genetic isolation and dispersal", below), should be pursued as a matter of urgency.

According to current preconceptions, involving minimal gene flow between a series of geographically isolated populations, it would be likely that considerable genetic diversity exists within the C. mydas complex - diversity that is not evident, or is but poorly represented, at the gross morphological level. The recent work noted below shows that the expected diversity is similarly poorly represented at the enzyme level.

Statements made more than a decade ago by Hirth (1971) seem still valid today: "It is best to use the binomial, Chelonia mydas, for all green turtles until a detailed taxonomic study is made ... the mydas complex may be one circumglobal "Rassenkreis" but with significant gaps between the eastern Pacific and western Atlantic-Caribbean populations and between the East African and West African populations." This view is adopted here, and we use the name C. mydas to refer to "Green Turtles" in general, including "Black Turtles", but with the recognition that we are dealing with a complex of populations that may be more or less genetically isolated one from another, and that at the very least would constitute a variable polytypic "superspecies". It may well be that the degree of isolation and divergence manifest in one or more elements of this complex is such that they would be more appropriately treated as discrete species; however, this remains to be comprehensively demonstrated.

INTRODUCTION

MARINE TURTLE BIOLOGY AND MANAGEMENT

It is necessary briefly to outline major features of life history before discussing in a little more detail certain aspects that are particularly relevant to sea turtle management.

Green Turtle - Life history

Based primarily on work done by Archie Carr and associates at Tortuguero beach (Costa Rica) (Carr et al., 1978; Carr, 1980; Carr, 1982, Carr 1985), an outline model has been developed of the life history of C. mydas, an essentially circum-tropical species which is characterised by herbivory and large-scale shifts in habitat according to age and reproductive state.

Hatchlings emerge, mostly at night, from eggs buried in beach sand and make their way to the sea, after which they are lost to observation for a small but unknown number of years; in some cases they are known to collect in driftlines of weed assembled by water movements. When 20-30 cm in size, possibly after an extended period circulating with major ocean currents, they re-appear in near-shore feeding and developmental habitats; in the case of C. mydas, these are primarily shallow-water zones of algae or sea grasses. It is thought that different age classes may move through a sequence of subtly different developmental habitats. When mature, after a period of some two to five decades, females typically migrate to a nesting beach, often used by aggregations of turtles, and possibly sometimes used by different populations at different times of year. Mating, in some cases at least, occurs off the nesting beach. It is suspected that this may be the beach on which the turtles were hatched, although there is no direct evidence whatsoever for this. The same foraging grounds may be used by turtles nesting at different and widely-separated beaches, and some turtles are known to make migrations even though suitable nesting beaches used by other populations exist nearby.

Mature females may, on average, remigrate at intervals of three years, and may lay three clutches of around 100-120 eggs each time. While only a minority of females have been shown, by tag records, to remigrate after the first time they are seen on a nest beach, it is suspected that remigration is more frequent, although often unrecorded owing to tag loss.

Although three is the figure often quoted as the average number of clutches per female per season, and is the exact mean of figures for four different populations tabulated by Hirth (1980), Mortimer (in litt., 31 December 1987) has concluded that in many cases this is probably an under-estimate. At both Ascension and Tortuguero, where estimates of three clutches per season have been based on tagging data, tagging efficiency has been far less than 100% (Mortimer, in litt.). Limpus (1980, cited in Mortimer) feels that female Chelonia mydas most probably lay an average of five or six clutches per season. This is a significant point, and highlights the potential errors involved in attempting to extrapolate from basic data on number of nests to an estimate of the number of female turtles nesting per season.

It may generally be the case that immature and sub-adult animals occur on feeding grounds with mature animals of the same population (from the same natal beach), that males occur on feeding grounds with females of the same population, and that males and females of the same population always migrate to the same nesting beach, perhaps together; but all these features remain to be demonstrated.

Table 1. C. mydas: mean size and productivity data, mainly after Hirth (1980; and sources cited therein). Additional data from: [1] Schulz (1975), [2] Servan (1977), [3] Hirth and Hollingworth (1973:8), [4] Hendrickson (1957, mean clutch number calculated from Fig. 10, p. 501), [5] Balazs (1980), [6] question mark suggested by Mortimer (in litt., 31 December 1987). Egg output per female per nesting season is calculated as the product of mean clutch size and mean number of clutches per season.

Locality	Carapace length of nesting females (cm)	Weight (kg)	Clutch size	Clutches per year	Eggs/female /breeding season
Atlantic					
Tortuguero (Costa Rica)	100.1	114	110	2.8 ?[6]	308
Suriname	109	182[1]	138	2.9	400
Ascension	108.1		115.5		
Indian Ocean					
Europa Island	108.9	175[2]	115.5		
Yemen (PDR)	96	114[3]	106		
South China Sea					
Sarawak	97.5	110.9[4]	104.7	4.12[4]	432
South Pacific					
Heron Island (Australia)	102.4		110	4.5	495
Central Pacific					
Hawaii	92.2	110[5]	104	1.8	187
East Pacific					
Naranjo (Costa Rica)	82.9		87		

The potential complexity of within-population grouping and movements in sea turtle species is demonstrated by results of a study on the Florida Caretta caretta population recently reported by Henwood (1987). The mature females that nest in the vicinity of Cape Canaveral are short term visitors that migrate into the area at two- or three-year intervals, and reside elsewhere in non-nesting years. Mature males appear not to migrate with the females, but are present in highest numbers about two months before the peak in female numbers. Some males have been recorded in the breeding assemblage in consecutive years and males may breed annually. Only a few adults of both sexes remain in the vicinity of the nest beaches throughout the year.

Except for the nesting season, sub-adult turtles are present near the nest beaches in good numbers throughout the year; they move opportunistically along the Atlantic coast, northward in summer and southward in winter.

Table 2. E. imbricata: mean size and productivity data, mainly after Limpus et al., (1983, and sources cited therein). Additional data: Tortuguero[2] - Bjorndal et al., (1985), Seychelles[2] - Brooke and Garnett (1983), [3] Mortimer (in litt., 31.12.87, opinion based on work in prep.), Puerto Rico - Olson (1985). Solomons[1] and Solomons[2] data from McKeown (1977) and Vaughan (1981) respectively. Egg output per female per breeding season is calculated as the product of mean clutch size and mean number of clutches per breeding year. Data on Hawksbill re-nesting are very sparse; fieldwork has generally not been undertaken throughout the suspected nest period for the species, and only the Cousin Island (Seychelles) work, where there has been a resident warden to monitor year-round nesting, is based on long-term survey data. Authors' suggested number of clutches per year are given for some sites outside Seychelles. Hawksbill clutches from a number of localities (not including Seychelles) have been found to contain a number of small yolk-less eggs.

Locality	Carapace length of nesting females (cm)	Weight (kg)	Clutch size	Clutches per year	Eggs/female /breeding season
Atlantic					
Tortuguero[1]	83.11		161.1	1-2 ?	
Tortuguero[2] (Costa Rica)	82	59	158		
Puerto Rico	80.8	72.06	157.6	1-4	94-606
Nicaragua	76.5	54.2		2-4 ?	
Red Sea					
Sudan	66		100.8		
Indian Ocean					
Cousin (Seychelles)	82.31		161[2]	2.76[2] 3-4[3]	444[2]
Yemen (PDR)	69.53	43.2	107.8		
Oman	73.3		108	2+ ?	
South Pacific					
Campbell I. (Torres Str.)	76.97	51.55	131.8		
Solomon Is[1]	80.72	66.4	137.5		
Solomon Is[2]	78.2	57.8	151		
W. Samoa	68.6		149.6		

Hawksbill - Life history

Whilst some elements of the life history of C. mydas are well established, much less is known of the Hawksbill. The species, circum-tropical in distribution, generally has been regarded as relatively sedentary, nesting and feeding on small beaches and coral reef shallows in close proximity to each other, and only rarely nesting in numbers. The species is essentially carnivorous, browsing over reef surfaces on sponges and other invertebrates, and over most of its range is more rare than C. mydas. Extensive cyclic migrations, as in C. mydas, have not been demonstrated, although some long distance movements are known. It seems likely that significant long range dispersal movements do occur, perhaps intermittently, or prior to adopting a more sedentary existence once suitable habitat is found. Because Hawksbill nesting is typically diffuse, and may take place at small and isolated beaches little used by other sea turtles, as well as in the midst of more dense nesting by other species, nesting numbers are particularly difficult to monitor. At some sites, turtles seem reluctant to move away from coral reef shallows into deeper waters, and what appear to be the same individuals may be seen in the same reef area for periods of many months; thus protected area management in coral reef zones may be an effective means of conserving Hawksbill populations (Goodwin and Reid, undated).

Tables 1 and 2 summarise selected size and productivity data from populations of both species.

Estimation of population size

The difficulties inherent in estimating population size in sea turtles have often been discussed (Meylan, 1982), and yet remain intractable. The females spend almost their entire lives at sea, emerging on land only to nest on sandy beaches, frequently three or more times in one season and sometimes (perhaps often) for only one season in their lives. The males generally never leave the water (but for one or two exceptional situations, such as in Hawaii and the Galapagos, where small numbers of turtles sometimes bask on land during the day). In general, only those turtles that forage in shallow inshore waters can be encountered at sea with any regularity, and C. mydas, which often occurs in aggregations over shallow-water seagrass pastures or other suitable feeding grounds, is near-unique among turtles in being amenable to study at some localities from the air or by boat (e.g. the Masirah Straits in Oman: Ross, 1985; around Heron Island, Australia: Limpus and Reed, 1985a).

With the exceptions given above, only parameters that can be measured on the nesting beach can be used to make an estimate of population size, and in fact the "population" being assessed is only the segment of the total mature female population that is nesting during any given season. Because females rarely nest every year, but more usually at two-, three- or four-year intervals, and because it is not possible to determine what proportion of the total mature female population is at the nest beach in any given year, significant error will be introduced by attempting to extrapolate from data on one season's nesting numbers to the total mature female population.

A further complication is the fact that long-term monitoring at several sites has shown that nesting numbers can show extreme variation from one year to another: at Heron Island (Queensland) more turtles nested in 1974-75 than ever before in living memory, but very little nesting occurred next season (Limpus, Fleay and Guinea, 1984); at Tortuguero (Costa Rica), around

5 000 C. mydas nested in 1979 and about 50 000 in 1980 (Carr et al., 1982). In other words, data from one or two years will be of limited use in an attempt to assess the mean size of the annual nesting population.

Limpus and Reed concluded from an assessment (by ovarian examination) of the reproductive condition of females on feeding grounds in the southern Great Barrier Reef (1985a), and of those from the Raine Island colony stranded off their feeding grounds by Cyclone Kathy (1985b), that observed broad annual fluctuations in nesting density may reflect conditions on the foraging grounds, in particular the number of females that have been able to prepare themselves for breeding, rather than annual fluctuations in the total population of mature females. Preparation for breeding, including the laying down of fat deposits and vitellogenesis, starts more than 12 months before nesting, and in northern Australia climatic fluctuations during this phase are directly correlated with fluctuations in nesting numbers two years later (Limpus and Nicholls, 1988). Limpus and Reed further point out (1985a) that because differing proportions of mature females breed in different years, and individual females do not breed annually, a very large feeding ground population, including all size classes from small immatures to mature adults, would be necessary to sustain even a moderate nesting colony of several hundred nesting females a year.

In the country accounts comprising the main body of this report, we have attempted to cite field-workers' basic data, such as emergences or nests per length of beach per unit time, or nesting numbers per night at peak season, and, when available, have quoted their estimates of total nesting numbers in a given season. Many authors have derived an approximation of annual female numbers from egg harvest data, by dividing the total egg harvest by the mean clutch size (figures of 100-120 are often used) and by the mean number of nests per female per season (often around three, but see above for other possibilities).

Estimates of nesting numbers of Eretmochelys will generally be even less reliable than for C. mydas because of the general tendency of the former to nest singly or in small numbers at scattered nesting beaches. Except in unusual situations where this species is the predominant nester and beaches can be regularly monitored (e.g. at Cousin Island, Seychelles), Hawksbill nests will often go unrecorded.

Reproductive remigration

Hughes (1982a) introduced yet another element of uncertainty into attempts to assess population size, namely, the fact that in all cases where suitable tagging programmes have been in operation, fewer than half the females nesting in any given season can be identified as remigrants, and they often form a minor proportion of total numbers nesting (sometimes less than 1% and rarely more than 20%). Although Bjorndal (in litt., 20 June 1987) has pointed out that Green Turtle remigrants recorded at the well-monitored Tortuguero beach (Costa Rica) have averaged 35% of total nesters over the past decade, and believes that the apparent losses are largely an artefact of incomplete beach coverage, even this high figure is lower than might be expected if remigration was predominant.

Hughes' evidence could be taken to suggest that a large proportion of nesting females nest in only one season. This assumes that the females will return to the same beach on each active nesting season, in order for monitoring of tag-bearing females to be possible. Whilst such philopatry

(see below) has been demonstrated at several sites, and is widely assumed to be a characteristic of marine turtles in general, one explanation for the low remigration percentages observed could be that a significant number of females, having been tagged on one beach, subsequently nest on other beaches where their tags go unrecorded. Since most beaches are not regularly monitored by research workers, the chances of discovering a female in the act of nesting on a beach other than the one she was originally tagged on may be low. On the other hand, in the Western Atlantic for example, beaches not monitored by turtle researchers are often monitored by turtle hunters, and the chance of a stray female being discovered is probably high. Whether the scientific community ever becomes aware of such incidents is of course dependent on the hunter returning any tag present, and tags recovered by other than turtle workers are very frequently not returned. However, in large populations, correspondingly large numbers of females would have to nest on different beaches to produce the low remigration rates observed, and this seems most implausible as a complete explanation for the phenomenon.

In some populations, the removal of potential remigrants by hunting at the nest beach or on feeding grounds is likely to account in part for low remigration rates. Bjorndal (in litt., 3 March 1989) considers this to be one of the most probable explanations for the low remigration recorded at Tortuguero. Another possibility, and the one most often discussed (e.g. Pritchard, 1980), is that many tags are lost from the animal bearing them and many remigrants thus cannot be detected. Alvarado et al. (1988) report results from an experiment in which turtles were double-tagged, with a metal tag (Monel alloy) on one fore flipper, and a plastic tag on the left hind. A total of 146 (83%) out of 175 turtles double-tagged in 1985 and 1986 were re-recorded in the same season. The overall loss rate of metal tags was 44%; that of plastic tags was only 2.8%. If these results can be taken as representative of the majority of tagging programmes, where it has been standard practice to use Monel tags, a very high rate of tag loss can be expected (although other variables, such as application site and technique would exert an effect), and this could largely account for the low remigration rates typically recorded. Balazs (1983) recorded a relatively low cumulative tag loss of 30% over a four year period; this may largely be due to the use of Inconel alloy tags rather than Monel, which corrodes more readily.

The fact that decline in nesting numbers in populations newly subject to intense turtle harvest can be extremely rapid (agassizii in Pacific Mexico, for example) strongly suggests that most females would in fact migrate to nest in more than one season if left alone to do so (because each season's harvest would then include a significant proportion of animals that would have been expected to nest in future seasons, thus accelerating the evident decline). Remigration is certainly high in the well-studied Georgia Caretta caretta population, where one female first tagged in 1964, not necessarily on her first nesting, was seen nesting several times in 1980 (in this population, data suggest that no female will survive more than 32 years after first nesting) (Frazer, 1983). The extent to which remigration is undetected or restricted owing to tag loss or the removal of tagged females from the population, are critical subjects for further study.

Migration and philopatry: females

The Green Turtle is remarkable for the regular long distance migrations shown by some populations, between widely separate feeding and breeding areas. In some cases, exemplified by the Ascension (nesting) - Brazil

(feeding) population, this involves long journeys across open ocean; in others, for example, the Costa Rica (nesting) - Nicaragua (feeding) population, the journey is shorter and primarily coastal. In yet other cases, Hawaii, for example, populations appear to be largely resident within one geopolitical unit, although reproductive migrations still exist.

Evidence from long-term tagging programmes has demonstrated that the species shows strong philopatry - females tend to return to the same nesting area on each reproductive migration.

As Carr (1975) noted, of the 1300 mature females that had been tagged on Ascension at that time none had been found nesting anywhere else. Similarly, of the approximately 30 000 female C. mydas tagged at Tortuguero (Costa Rica), none has been recorded nesting anywhere else (Carr, Carr and Meylan, 1978; Bjorndal, in litt., 1987). At the three "turtle islands" in Sarawak, of 5,748 nesting records only 3.7% showed a change of island from that used on the previous nesting emergence; this is particularly remarkable since most such changes involved two islands only 500 m apart (Hendrickson, 1958). In Suriname, no female that had been tagged elsewhere was ever found, and with the exception of "a few" that renested in the same season in adjacent French Guiana, no Suriname Green Turtle has been shown to nest elsewhere (Schulz, 1975).

However, some cases of imperfect philopatry are known. There is, for example, significant shifting between the two main nesting beaches in Suriname (some 70 km apart) both within and between seasons (Schulz, 1975). In Galapagos, some 10% of turtles observed more than once during a season emerged on at least two different beaches (though not all emergences resulted in nesting), while 12% of remigrating turtles moved beaches, half of these moving islands. Turtles bearing tags either known or assumed to be from the Sarawak Turtle Islands have reportedly been seen on several occasions on the Paloh beaches in north-west Kalimantan, and in the South Natuna Islands (Schulz, 1987).

One C. mydas observed nesting on Mona Island (Puerto Rica) had previously been tagged on the beach (without nesting) at Aves Island (Venezuela), a straight line distance of some 560 km (Kontos et al., 1988). Perhaps the most interesting example of imperfect philopatry concerns a female tagged while nesting on Tromelin on 30 December 1973 and re-recorded on two successive nights (2-3 December 1982) on a nesting beach on Europa (Le Gall and Hughes, 1987). These two islands are well over 2000 km apart by sea. They include, owing to the research programme carried out by French workers over recent years, almost the only regularly monitored C. mydas nest beaches in the entire Indian Ocean. Of the extensive nest beaches on Europa, only Station Beach is regularly surveyed. In these circumstances, even a single demonstrated long-distance shift in nest site suggests the possibility that such events may be more frequent, and that local C. mydas populations may be less genetically-closed than is often suspected to be the case.

If all nesting females from one population always nested only on one given beach, dispersal and colonisation of new or more favourable nesting habitat would not occur. That dispersal does occur is shown by the fact that both C. mydas and E. imbricata nest on certain beaches on Krakatau formed since the eruption in 1883 (Salm et al., 1982).

Migration and philopatry: males

Overall, whilst there is very little direct information on long distance reproductive movements of adult male sea turtles, the few data that are available are consistent with the pattern demonstrated for adult females.

Virtually all tagging programmes have exclusively involved tagging females on the nesting beach; very few males have ever been tagged and, in the general absence of suitable tag-return data, there is very little evidence for philopatry in males. Males, of course, contribute half of the total genetic constitution of the population. It may well be the case that males feed and migrate with the females from each population, but perhaps some proportion of them disperse widely and subsequently join any convenient female aggregation.

The best evidence available on male movements in Chelonia mydas relates to the apparently isolated C. mydas population in Hawaii (Dizon and Balazs, 1982). Two males, tagged in 1975 and 1970, were recorded to remigrate to the same nest area in later years, in 1976 and 1977, and in 1979, respectively (radio telemetry indicated that both males and females remain closely associated with the nesting beach area during the nesting season). Overall, during the ten-year period up to 1982, 294 turtles tagged at the Hawaii nesting ground have been re-sighted, and this includes 87 males (Balazs, 1983). Seven of these males have been shown to make long distance migrations between feeding grounds and the nesting area (or vice versa), and one of the seven has been recorded to make the return journey from feeding grounds to the nesting area and back (Balazs, 1983). Three of 575 males tagged in the Galapagos, presumably while breeding, were subsequently recaptured; one in Costa Rica and two in Peru (Green, 1984a). Similarly, two males tagged on Scilly in French Polynesia were subsequently recaptured in Fiji; females from this population have also been recaptured at other sites in western Oceania (Anon, 1979).

Hawksbill migration

Although little concerted tagging of Hawksbills has been undertaken, and is difficult in the absence of dense nesting aggregations, there is little evidence as yet to counter the prevailing notion that the species tends to be a mainly sedentary coral reef dweller; equally, there is little evidence substantiating the idea. A few examples of apparently purposeful long-distance migration are known (Parmenter, 1983). These include: movement between the Solomon Islands and Papua New Guinea, the Torres Straits and the Solomons, Sabah and the central Philippines, Tortuguero (Costa Rica) and Nicaragua. It may well be that the small number of reported long distance movements is a simple function of the small number of Hawksbills that have been tagged and recaptured, and it is possible that individuals move long distances between feeding and nesting areas, and among different feeding areas, more commonly than observations indicate.

Maturation period

Captive-reared Green Turtle females (at Cayman Turtle Farm) become sexually mature at a minimum of 8 or 9 years; the mean age of maturation at CTF is probably greater than this (Wood and Wood, 1980), perhaps 10 or 11 years or more. Until quite recently it had widely been assumed that maturation in the wild occurred after a similar period (sources cited by Hirth, 1971).

Growth rates are dependent perhaps on water temperature and certainly on the quality and quantity of food available; growth rates in the wild are thus likely to differ markedly from rates observed in captivity (Frazer and Ehrhart, 1985), where foraging effort can be low and food availability high. Balazs (1982: 122) reported, for Green Turtles in Hawaii, that small immatures of 35 cm carapace length (age unknown) would require between 10.8 and 59.4 years to reach 92 cm, the mean size of nesting females in Hawaii. This is corroborated by recent skeletochronological data suggesting that 40-50 years may be required to reach maturation, if this occurs at over 81 cm carapace length (Zug and Balazs, 1985). Different maturation times shown by populations in different parts of the archipelago are attributed to differences in food availability (Balazs, 1982: 123); algal species not generally preferred in the diet are the only food sources available in the north-west, where growth is slowest. Similarly, Limpus (1979) produced evidence that Green Turtles in the southern Great Barrier Reef would not reach maturity in under 30 years. In Florida, the mean age at maturity is estimated at 27 years (Frazer and Ehrhart, 1985), or 25-30 years at first breeding (Mendonça, 1981).

Frazer and Ladner (1986) constructed a growth curve for C. mydas in the US Virgin Islands and calculated from it that the mean age at maturity of females at Ascension, Costa Rica and Suriname is close to 33, 25 and 35 years respectively. On the other hand, bone growth marks in a single specimen from Canton Island (Phoenix group, South Pacific) suggested an age of 15 years at a carapace length of 90 cm; this may reflect faster growth in warmer waters (although the authors urge caution in interpreting data from single samples) (Zug and Balazs, 1985).

Similar growth rate/maturation data are not yet available for the Hawksbill. There are indications, however, that on the Great Barrier Reef at least, Hawksbills do not differ markedly from Greens in this respect (Limpus, 1980). On the other hand, if delayed maturation in the Green Turtle is attributable to its strict herbivory and correlated nutrient limitation (Bjorndal, 1985), the largely carnivorous diet of the Hawksbill might be expected to allow faster growth and earlier maturation. Recent data from feeding grounds in the southern Bahamas (Bjorndal and Bolten, 1988) indicate that rate of growth in mass is about 1.5 times greater in Hawksbills than in Green Turtles, and for individuals of the same size, rate of growth in carapace length is much greater in the former than the latter.

A major practical consequence of late maturation is simply that the effects of any human interference with wild populations, in particular with the reproductive success of nesting females, will take a long time to become manifest as changes in population status. As Bjorndal (1985: 748) pointed out, if the typical age at maturity in a Green Turtle population is 20 to 30 years, then because of the accumulation of age classes progressing, with time, closer to maturity, every turtle and every egg could be taken from year one until year 20 (30) without any decrease in the number of turtles arriving on the nesting beach. If there was total harvest for 20 to 30 years, the population would then suddenly collapse (assuming that no immigration from neighbouring populations occurs). Ehrenfeld (in Bacon et al., 1984, Vol. 1: 148) has lucidly represented this situation as follows: "Looking at green turtle population data, for example, is like looking at the light from a star 25 light years away: it appears to be shining now, but in fact, you are looking at history, and there is no way of telling whether, during the past 25 years, that star has increased in brightness, or perhaps has gone out altogether."

But harvesting is rarely quite so intense for quite such long periods, and late maturation can in a sense be said to protect populations from extirpation (Bjorndal, 1985) because if harvesting is variable through time, there may be sufficient numbers of various age classes surviving harvest to maintain the population. Furthermore, present population data are not only a reflection of the nesting success of the previous generation, perhaps 25 years ago, but also of conditions in the feeding and developmental habitats used by immatures and sub-adults. A contemporary reduction in artifical mortality suffered on foraging grounds by near-adults could, in principle, result in an increase in nesting numbers in the very near future.

While late maturation may serve to buffer populations from extirpation, it also simultaneously both conceals the effects of exploitation, which may eventually turn out to have been excessive, and conceals the effects of conservation action at the nesting beach, which may be abandoned before any benefits could have been expected. Masking of the effects of exploitation can be particularly misleading, as shown by the following statement regarding Green Turtles at Assumption, made by the Director of Agriculture in the Seychelles in 1929 (cited by Mortimer, 1985:9): "It is wonderful, however, to think that after 19 years of constant fishing the resources in turtle have not been depleted except to a slight extent; 1000 turtles are still captured per annum". As Mortimer points out, this "constant fishing" eventually resulted in the decline of the Assumption nesting population from several thousand females annually to only around 200 annually. A similar belief, that the turtle resource is inexhaustible, has been widely recorded among coastal peoples who utilise turtles.

Genetic isolation and dispersal

The strong philopatry that has amply been demonstrated in a number of C. mydas populations, coupled with the fact that mating often occurs just offshore from the nesting beach, seems to be the basis for the frequently-cited statements to the effect that "each nesting colony is therefore a separate reproductive unit that does not demographically reinforce any other" (Carr and Stancyk, 1975:171). Similarly, "each sea turtle nesting population is genetically isolated and distinct and cannot replenish other such populations", and "each turtle population must be treated as a discrete entity for the purposes of conservation" (Ross, et al., 1979).

While it is reasonable to accept this as a working hypothesis, it is not yet fully confirmed by available evidence. For example, in the present absence of any standard method for marking hatchlings, there is no evidence whatsoever that a mature female on her first nesting emergence has returned to her natal beach. It is an assumption, and should be recognised as such, no matter how plausible it may seem. If she has not returned to her natal beach, then significant between-population gene flow will have occurred.

Recent electrophoretic work does not provide evidence for the high level of between-population genetic diversity in C. mydas that would be expected under conditions of strict genetic isolation. A study of 16 enzyme loci in Green Turtles from Costa Rica and Florida demonstrated polymorphism in four, with only phosphoglucomutose showing highly significant genotypic and allelic differences between the samples (Kochinsky and Menzies, 1983). Similarly, an electrophoretic survey of 23 loci in four Green Turtle samples, from the three main tropical ocean basins, demonstrated very little heterozygosity, suggesting that rates of enzyme evolution may be very slow

and that gene flow is sufficiently high to maintain a rather homogenous gene pool (Bonhomme et al., 1987). Although an earlier and more restricted survey of 13 loci (Smith et al., 1977) demonstrated moderately high heterozygosity in C. mydas, the significance of this is uncertain because half of the sample was composed of a mixture of animals from eggs laid in captivity at Cayman Turtle Farm, derived from three different sources in the Caribbean.

Bowen et al. (1989) report results of a recent study of mitochondrial DNA sequences in C. mydas samples from four localities (Hawaii, Florida, Venezuela, Ascension). The study revealed that the three Atlantic colonies are very closely related, with all samples sharing at least 93 of 95 restriction sites. Three mtDNA genotypes were found, each of the three Atlantic samples were characterised by a pattern not observed in other samples, but the three genotypes differed only by one or two mutation steps. This does suggest, as stated by Bowen et al., "a contemporary restriction of female-mediated gene flow between Atlantic rookeries", but the overall pattern is of close similarity between localities rather than of marked difference. The Hawaiian sample was readily distinguished from Atlantic samples by five restriction enzymes, with a total difference of six mutation steps.

In summary, none of the work reported to date has provided experimental evidence of near-complete genetic isolation of geographically isolated nesting aggregations. What is known is that in all cases for which good tag-return data exist, nesting females, when they nest in more than one season, typically nest again on the beach on which they first nested. What is widely suspected, but not yet demonstrated, is that mature males and females return to their natal beach, and that each nesting colony is a separate and closed reproductive unit. Experimental investigation of the natal beach hypothesis will require marking of hatchlings using sophisticated techniques similar to those used in the study of migratory fish stocks.

The study of mitochondrial DNA sequences in C. mydas by Bowen et al. (1989) revealed that the Ascension sample is closely allied to other Atlantic samples. Ascension Island has been isolated for more than 40 million years as a result of sea-floor spreading, and genetic isolation of the Ascension C. mydas population for this period of time should, even allowing for a reduced mutation rate owing to long generation time, have resulted in radical changes in nucleotide sequence. This was not observed, and Bowen et al. conclude that the Ascension Island population, or extensive gene flow into it, has been of recent origin.

More general discussion of their mtDNA sequence results led Bowen et al. (1989) to suggest that natal homing operates on a regional basis, rather that being specific to one nesting beach, and that a Green Turtle "population" consists of clusters of neighbouring nesting colonies, rather than being equivalent to a single nesting colony. Gyuris and Limpus (1988) recently reported very low electrophoretic variability in Caretta from mainland and island nest sites in east Australia, despite an extremely low interchange of individual turtles between sites. They attributed this in part to multiple paternity (Harry and Briscoe, 1988) and the probability that the genetic input of males is distributed after mating to both mainland and Capricornia Reef rookery sites. Again, the basic "population" consists of a cluster of neighbouring nesting colonies.

If the details of homing behaviour were learned rather than inherited, a flexible response to changing nesting opportunities (consequent upon island formation, erosion, sea level changes, colonisation by predators, etc.) would be possible. As Bowen et al., point out, "a new migrational circuit could be established by a single female in a single generation". On a similar theme, Hendrickson some time ago (1958:462) proposed that newly-matured females may constitute a "pioneering fringe" of the main population, able to range widely through a region of potential nesting habitat, but able in subsequent nesting years to home in, by means of a learned response to certain environmental cues, to whatever beach first provided them with suitable nesting conditions. Gyuris and Limpus (1988) also suggest that social facilitation and learning should be considered as an alternative to the natal beach imprinting model as a basis for sea turtle dispersal and migration (and see Owens et al., 1982).

It might be the case that immatures and sub-adults from different nesting beaches may intermix while at their foraging grounds, or may associate on their first nesting with experienced nesters from different nesting beaches than their own. This is purely speculation, but combined with observations and ideas outlined above, suggests a model predicting significant inter-population gene flow up to the near-mature phase, but subsequently minimal gene flow between each nesting colony owing to a learned homing behaviour demonstrated by adults. This model predicts that nesting populations based on discrete beaches will not be completely isolated genetically one from another, but that the degree of genetic isolation will be largely a function of the degree of physical separation between nest beaches, and the opportunities afforded for intermixture of pre-adults in their developmental and foraging habitats.

Population structure: some consequences for conservation

Even if nesting site populations are not completely isolated genetically, and even if, over evolutionary time, significant powers of dispersal are evident, it remains true that populations appear to have little ability demographically to reinforce one another. Once a population is extirpated, there is no direct evidence that it can in practice be restored by turtles derived from neighbouring populations thus they should still be treated as discrete entities for conservation purposes (Mortimer, in litt., 31 December 1987).

The nearby islands of Assumption and Aldabra (Seychelles) provide a particularly relevant example (Mortimer, in litt., 1987). Both historically supported very large nesting populations. Nesting numbers at Assumption are now very low after many years of exploitation earlier this century; Aldabra still supports a reasonable population which may be recovering as a result of local protection since 1968. Although some Aldabra females may nest on Assumption, the Assumption population has remained in a severely depleted state since at least the early 1970s. Similarly, the Cayman Islands and Bermuda populations, both reduced to vestigial levels by the end of the last century, have not been restored by turtles derived from the large and flourishing Tortuguero population (Costa Rica) even though all three may have shared the same feeding grounds (Mortimer, in litt., 1987). However, although turtle colonies no longer nest on Réunion and Mauritius, feeding turtles occur offshore and some nesting attempts have been recorded on both islands; disturbance may deter increased nesting.

INTRODUCTION

Although re-colonisation of former nesting beaches, or reinforcement of depleted populations, would in principle be expected given significant powers of dispersal, these phenomena would not in practice be expected to take place over a time span of only a few decades. Late maturity, combined with a large element of chance, means that restoration of former nesting colonies could, in most cases, barely be perceptible in the brief period during which marine turtle populations have been receiving scientific attention.

TURTLE EXPLOITATION

Turtle products: edible

The eggs of all species of sea turtle are widely used for food. Whilst Hawksbill flesh is consumed in some areas, generally it is not greatly favoured; it has been responsible for a number of instances of food poisoning, and some fatalities. Green Turtle meat is widely utilised, and cartilage has been sought by luxury markets for the preparation of "turtle soup" since at least the seventeenth century in Western Europe, and subsequently in North America also. The term "calipee" is used generally for the cartilage lining the plastron (ventral portion of the shell), often light greenish in colour, and "calipash" for the darker cartilaginous portions associated with the carapace (dorsal shell) and vertebral column (Parsons, 1962); sometimes all such cartilage is collectively referred to as calipee. Nearly half the wet weight of a Green Turtle constitutes edible protein, according to figures cited by Hirth (1971). Hirth (1968) stated that 40-50 % of the body weight of C. mydas formed edible meat. There is a widespread belief in the medicinal properties of turtle oil, and it is particularly attributed with the ability to cure various bronchial complaints.

Turtle products: non-edible

"Tortoiseshell", referred to as "bekko" in the Japanese trade (now by far the world's largest consumer of shell), has long been in demand for its decorative qualities. It is much thicker than the shell of other species of turtle and can be carved in single thicknesses or laminated together to form larger structures. The large plates of the dorsal carapace (usually 13 per turtle) have the greatest value, while those of the plastron are seldom used. The marginal scutes, often referred to as "hooves" or "claws" may occasionally be carved into jewellery. The shell of wild C. mydas, which is very thin, has very little value and has only been extensively used for marquetry. Oil rendered from turtle fat, seemingly from C. mydas more often than E. imbricata, has long been in use as fuel, lubricant and waterproofing agent, and in cosmetics. The demand for turtle skin, which can be tanned into an attractive leather, has newly-arisen in the last few decades.

Certain relevant data concerning individual productivity of turtle commodities are summarised in Tables 3 and 4.

According to Witzell (1983), the amount of shell that can be derived from an adult Hawksbill varies with age and size from 1 to 6 kg, with 3.3 kg being the mean of values cited in 12 literature sources. This value presumably refers to all of the shell plates, rather than only the dorsal scutes which are normally marketed. Parsons (1972) stated that a good-sized Hawksbill may produce 3-4 lb (1.4-1.8 kg) of tortoiseshell. Hornell's (1927) Seychelles data, cited below, are from a region with Hawksbills of

relatively large average size. Schulz (1987) reported that 13 carapace plates from the large Hawksbills sometimes to be found in the region of the Moluccas and Irian Jaya, the source of the thickest and highest quality shell in Indonesia, could weigh around 4 kg, but this appears to be exceptional. Milliken and Tokunaga (1987a) assessed the weight of bekko imported to Japan from 42 countries between 1984 and 1986. The overall average for this period was 1.06 kg of dorsal shell per animal, but the weights of shell from different regions varied considerably, the Caribbean producing the heaviest shell, at 1.34 kg, and the Indian Ocean/Africa the lightest at 0.74 kg (see Table 4). There does not appear to be a precise correlation between the length of carapace and the weight of shell to be obtained from it, as the data in Table 5 indicate.

Table 3. C. mydas parts and products: (A) weight of various body parts of a 96 kg female C. mydas from the Gulf of Mexico (data from Ingle and Smith, cited by Hirth, 1971) (the figures for meat alone are calculated using general percentages from sources cited by Hirth); (B) weight of calipee from Seychelles turtles, data from Hornell (1927); (C) weight of meat from a 140-kg Seychelles female, data from Mortimer (1984); (D) weight of products from a 99-kg female slaughtered at Aden, Yemen (PDR) (in this case the weight figures are virtually equivalent to percentages)(Hirth and Hollingworth, 1973).

Item	Weight (kg)	Percentage of total
(A)		
Meat plus flippers	49.9	52 %
Meat alone	42.7	40-41.9 %
Calipee	6.4	6.7 %
Carapace	14.9	15.5 %
Entrails	10.1	10.5 %
Head	2.3	2.4 %
Tail	.2	.24 %
Neck	1.6	1.7 %
Major organs	2.6	2.73 %
(B)		
Calipee	1.5	1.1 %
	(average turtle weight of 300 lb [136 kg])	
(C)		
Meat, flippers, tail, neck (wet weight)	55.5	39.6 %
Meat, flippers, tail, neck (dry, salted)	19.0	13.6 %
Intestines	7.0	5.0 %
(D)		
Meat (from body plus flippers)	28.4	
Calipee (plastron plus carapace)	5.7	
Fat	3.	

Hornell (1927) also noted reports that results of a trial captive-rearing operation for E. imbricata in the Seychelles indicated that animals would have to be raised for 15-20 years before shell equivalent in weight to that from wild-caught turtles would be produced. Growth rate would presumably vary greatly according to diet and living conditions, among other factors.

Table 4. Mean weight of tortoiseshell per turtle: (A) from a sample of 60 animals, and (B) from a second sample of nine animals, all from the Seychelles, data from Hornell, 1927; (C) from dorsal scutes imported into Japan, from seven Caribbean countries (Panama, Belize, Cuba, Haiti, St Vincent, Trinidad and Tobago, Antigua and Barbuda), two African countries (Kenya, Ethiopia), and from four Asian countries (Indonesia, [Singapore], Phillipines, Taiwan), data from Milliken and Tokunaga (1987a).

Item	Mean weight (kg)	Typical number of plates
(A): Seychelles (n = 60)		
Carapace	1.1	13
Plastron ("Yellow belly")	.19	
Marginals ("Hoofs" or "Claws")	.33	27
Total	1.62	
(B): Seychelles (n = 9)		
Carapace	1.43	
Plastron	.50	
Marginals	.21	
Total	2.14	
(C): mixed		
Caribbean (n = 14693)	1.34	
Africa/Indian Ocean (n = 7133)	0.74	
S.E. Asia (n = 11159)	0.75	

Table 5. Weights of tortoiseshell derived from carapaces of different lengths (data from Hornell (1927), from Seychelles).

Carapace length (cm)	Weight of shell (kg)
71.12 (28 in)	1.02
"	2.20
"	.88
73.66 (29 in)	.87
"	1.45
"	1.33
81.28 (32 in)	1.54
86.36 (34 in)	1.88

Methods of turtle exploitation

Various general strategies of turtle exploitation have been practised in different parts of the world and these demonstrably have had, or theoretically are expected to have, different effects on turtle populations. Wild turtle populations may be exploited by the collection of eggs, by the killing of adults and sub-adults, or by the collection of eggs or hatchlings for ranching operations. The most technologically advanced, and as yet unrealised scheme involves closed-cycle captive breeding.

Egg harvesting

In many parts of the world, egg harvesting is carried out on a subsistence level by the coastal inhabitants, and consequently the past or present levels of collection are impossible to determine. Furthermore, it is usually combined with the capture of nesting females, and so its effects are impossible to monitor or separate from those of the adult harvest. However, there are a few localities where the egg harvesting is well documented over a very long period and the harvest of adults is of minimum significance. These examples give us not only the best evidence of long-term fluctuations in nesting populations but also of the effects of egg harvesting.

The harvest on Diamond Island off Burma has the earliest documented history. Maxwell (1911) recorded the harvests from 1883 to 1898, and showed that they were in the region of two million eggs a year. He considered that about 94% of eggs laid were collected, and said that this intensity of harvest appeared to have continued unchanged since at least 1870 and probably earlier. The next documented record of harvests on Diamond Island were from 1977 to 1982, which showed that they had declined to between 152 000 and 238 000 a year, the collection regime and the intensity of harvesting apparently having changed hardly at all since 1883 (Salter, 1983). This represents a decline of about an order of magnitude over a hundred years equivalent to only about 2% a year. Maxwell (1911) considered that the harvests in the late 19th century had remained approximately constant over about 15 years, but a re-examination of his data shows a decline of 2.4% a year. Thus it appears that this low rate of decline may have persisted for the next 100 years under harvesting intensity of between 90 and 95% of all the eggs laid. Corroborative evidence for this theory was found from the egg harvest at South Moscos Island, which declined at a similar rate from 60 000 in 1939 to 21 000 in 1977 (Salter, 1983). Maxwell marvelled at the apparently insignificant effect that a near-total egg harvest for many years had had on the numbers nesting, and concluded that the nesting population must represent turtles immigrating from breeding beaches elsewhere. We now know that a large egg harvest should have little effect on the nesting numbers for at least 30 years, but we also know that Maxwell's immigration theory was probably incorrect, and our surprise should be all the greater that the harvest, continuing for over 100 years, should have caused the population to decline so slowly. There seem to be only four explanations which could account for this: a) the level of harvest has been grossly over-estimated; b) the harvest has not remained constant over the whole period; c) the age at first breeding is considerably more than 30 years and that the females continue breeding to an age of over 100 years; d) that the natural mortality of hatchlings is highly density-dependent, so that the majority survive if only a few hatch.

The next longest record of an egg harvest dates back to 1927 from the Turtle Islands off Sarawak and has been discussed many times (see Malaysia section for references). Over a period of 58 years, the egg harvest has declined from between two and three million to about 140 000. The level of harvest was estimated to be between 90 and 100% prior to 1978, but since then up to 50% of the eggs have been transplanted to a hatchery and the hatchlings released. The harvest on these islands is known to date back at least to the mid-19th century, but the intensity is not known, although it is thought to have been high. Between 1947 and 1985 the egg harvest, and by inference the nesting population, declined by an average of 7% a year.

Malaysian turtle eggs have also been harvested on some offshore islands off Sabah. Records date back to 1947, but are considered unreliable prior to 1965. From then until 1985, the egg yield declined by an average of 3.4% a year, although since 1973 nearly all of the eggs have been transferred to hatcheries rather than being sold.

Polunin and Nuitja (1982) assessed historical data on egg yields from two localities in Thailand and three in Indonesia, demonstrating declines at all five, though the time spans were too short to justify statistical analysis. Egg yields from the Turtle Islands in the south-western Philippines have been documented intermittently since 1950, and indicate a decline.

On the other side of the world, Suriname is another locality where egg collecting (C. mydas) is heavy but the adults are not exploited to any great extent. Prior to 1969, there was little protection, and Schulz (1975) estimated that the level of egg harvesting had gradually increased to about 90% of all those laid. From 1970 onwards, attempts have been made to reduce the harvests, which have now fallen to about 20-60% of the total production. The numbers of females nesting each year have fluctuated considerably, but they appear to show some evidence of a slight increase since 1967. Contrary to some claims, this increase should not be attributed to the undoubted improvements in the control of the egg harvest, because females from eggs laid since 1970 are unlikely to have yet returned to start breeding.

Hendrickson (1958) originally pointed out, discussing C. mydas in particular, that if each egg weighs around 35 g, and each female lays around 600 eggs per season, her production would amount to some 20 kg of protein-rich food a season. Approximately half the body weight of a 120 kg female, or 60 kg, would be edible meat, so a female would have to nest in three seasons for the weight of food provided by her eggs to equal the weight of food provided by the carcass. Hendrickson goes on to argue that, since a female may survive to lay eggs in more than three years, whereas slaughter of a female is a terminal event, utilisation of eggs would be the preferred mode of utilisation. This conclusion assumes that almost all of the annual egg production could be harvested without significant damage to the nesting population, and that remigration is a more frequent phenomenon than has been demonstrated to date. Mrosovsky (1983) and others have stressed that egg harvesting, particularly if other egg predators are discouraged and if eggs doomed to inundation are taken, is a far preferable strategy to the harvesting of adult turtles, not only because it should be less damaging to the survival of the breeding population if carried out in moderation, but also because it can result in a far higher yield of edible material. However, history has shown that moderation is seldom exercised, and that prolonged egg harvests appear usually to result in substantial declines in the breeding populations, although the rates of decline under

extremely heavy harvesting regimes are surprisingly slow. Pritchard (1982c) pointed out that "rapid recovery of a Green Turtle population that has been subject to complete or nearly complete egg exploitation is probably impossible", saying that such populations might need protection for several decades before they would show signs of recovery. Thus, although egg harvesting has the potential for being a good way of sustainably harvesting sea turtle populations, it has its dangers, and requires far greater control than is usually exercised. Some of the financial implications of sustainable egg harvesting are discussed later.

Turtle harvests

This category will be taken to include any killing of post-hatchling turtles, from juveniles up to mature breeding adults. For practical reasons, it is usually breeding animals that are taken. Several authors (e.g. King, 1982; Mrosovsky, 1983) have commented on the dismal history of exploitation of adult C. mydas which has frequently resulted in the local depletion of populations, in some cases leading to extinction. Techniques for estimating turtle populations have only recently been developed, and so it is rarely possible to document trends in wild populations; more often the historical harvest figures are used to indicate what the wild populations once were. However, some indication of the past impact of turtle exploitation can be inferred from the present distribution of turtles.

Nearly all of the major remaining Green Turtle rookeries are located on islands. This is not for want of any suitable sandy beaches on the mainland, and so some other explanation must be sought. The most plausible hypothesis is because of disturbance or predation by terrestrial animals. A variety of non-human predators are known to dig up and destroy turtle nests, and in some cases this may result in heavy mortality. The predators range from ants to pigs and many are absent from offshore islands (Stancyk, 1982). Some of the worst predators, feral pigs and dogs, are associated with human presence, but their effect is probably minimal in comparison with direct human predation. Only humans regularly kill substantial numbers of adult turtles; the other predators mostly confine themselves to eggs, and this form of exploitation is thought to be less damaging. It thus appears that human predation may be primarily responsible for the present distribution of turtle nesting colonies, and this is corroborated by the fact that several islands which formerly held breeding colonies are known to have lost them only after they became inhabited by humans. Examples include Mauritius, Réunion, the Cayman Islands and Bermuda. Mainland nesting colonies in the New World, particularly Mexico, but also Colombia and others, have been depleted in historical times after the onset of human exploitation, and the only remaining mainland nesting beaches are in places where they have not, until recently, been much exploited. This may be for reasons of inaccessibility, such as Costa Rica, or because of religious customs forbidding the consumption of turtle meat, such as Somalia, the Arabian Peninsula, Burma, Malaysia and, formerly, Indonesia. Africa, the continent with the longest history of human habitation, has no large mainland rookeries of C. mydas outside Somalia. Of course, it could be argued that it was not necessarily predation killing turtles, but disturbance that had caused turtles to move to offshore islands. However, the marked philopatry of nesting turtles argues against this.

There is also some good documented evidence of declines in C. mydas populations subject to heavy exploitation (see Table 11). Some of these declines have been extremely rapid. The vast Cayman Island rookery was

virtually eliminated in 100 years (King, 1982). On Aves Island, nesting numbers probably dropped by two orders of magnitude between 1947 and 1979 (Pritchard and Trebbau, 1984). The harvest on the Pacific coast of Mexico built up from very low levels in the 1950s to a peak in 1968, followed by a sharp fall until the present, caused by a population decline. The export of calipee from the Seychelles declined by two orders of magnitude between 1907 and 1970. In the Ogasawara Islands (Japan), the harvest fell from nearly 2000 in 1880 to about 200 in 1920 (Kurata, 1979). A decline in the nesting population on Aldabra was reversed after the atoll received protection as a nature reserve (Mortimer, 1985a). The huge harvest of turtles for the sale of meat in Bali has resulted in the fishermen having to travel further afield to find large turtles: good evidence of the severe depletion of local stocks within the space of ten years (Anon., 1984c).

It has frequently been pointed out that the harvest of turtles on, or just off, nesting beaches is particularly damaging as it takes primarily mature females. Turtles are particularly vulnerable during nesting because they emerge onto land, and every female turtle which is to contribute to the next generation must do so. Thus by killing before it lays its eggs every female that emerges, by no means an impossible or unusual achievement, the ultimate extinction of the local population can be assured. For the rest of their life-cycle, the turtles disperse into the sea and are much less easy to hunt with the same lethal efficiency, although they may congregate over the feeding grounds, and in this respect their capture is similar to the exploitation of marine fish. Marine fisheries are notoriously hard to control, as the fish populations are difficult to monitor and they are often exploited by a number of different nations. This history of fisheries control is depressing, in that many stocks have suffered severe declines as a result of over-fishing, but no marine fish is known to have become extinct as a result of fishing, probably because remote fishing techniques are inherently inefficient. Turtles combine the worst attributes of terrestrial animals and fishes, in that they are easy to hunt and the fishery is difficult to control. It would be expected that fishing for turtles offshore, outside the breeding season should be less damaging than catching them near the breeding beaches. There are few documented examples where offshore fishing is not combined with beach collection, and so it is difficult to test this hypothesis. The nesting populations of Europa and Tromelin are not exploited, except for the ranch on Réunion, but females tagged on these islands have been caught around Madagascar and Mauritius, both of which countries operate a sizeable fishery. So far as is known, the breeding populations do not appear to have been depleted by this activity. In a similar way, the turtles nesting on Ascension are caught off the South American coast, and yet no population decline has been recorded. One of the largest offshore turtle fisheries operates in the Torres Strait, where boats from both Papua New Guinea and the Australian islands catch turtles but again no decline to the nesting population in Australia has been recorded. A note of caution sounds from studies in the Caribbean, where the C. mydas population nesting on Tortuguero, Costa Rica, is exploited on feeding grounds off the Nicaraguan coast. A marked decrease in abundance of turtles off Nicaragua has been reported (Neitschmann, 1982), and although there has been no apparent decline in the numbers nesting at Tortuguero between 1971 and 1985, Bjorndal (1980) inferred increased mortality of tagged turtles.

The conclusion must be that sustained harvesting of nesting C. mydas carries a high risk of over-exploitation, and almost inevitably leads to local population depletion and quite possibly extinction. The effects of harvesting foraging populations offshore are less well known, but logic

would suggest that it should be less immediately damaging, and there is some evidence that this is the case although it too can undoubtedly result in reducing populations.

Although turtle population dynamics are incompletely known, it is generally believed that survivorship is lowest among eggs and hatchlings and highest in adults (Frazer, 1986). In a stage-based population model based on the very extensive Little Cumberland Island (Georgia) Caretta data, differential survival of juveniles and sub-adults had the greatest effect on population growth, even though sub-adults and especially adults have high reproductive value for the population (Crouse et al., 1987). Even total lack of egg and hatchling mortality could not prevent extinction of the model population, whereas an increase in juvenile and sub-adult survival reversed decline (Crouse et al., 1987) (in this population, these classes suffer high mortality from incidental catch). This suggests, to the extent that the model is valid for other populations and other species, that efforts should be made to protect juveniles and sub-adults as well as mature animals (Crouse et al., 1987; Crouse, 1989; Frazer, 1989). A more general conclusion is that population strength is "the integrative result of survival, fecundity, and individual growth throughout the life cycle", and that high nesting numbers alone may be deceptive as a measure of the health of a population (Crouse et al., 1987: 1420).

Captive-breeding

Closed-cycle captive-breeding operations are often seen as the goal for turtle exploitation schemes because, once set up, they need have no direct effect on the conservation of wild sea turtle populations. Indeed, if captive-breeding could be established as a reliable source of stock, whole new farms could be set up without ever taking a turtle or its egg from the wild. There are, of course, severe practical difficulties, because it has not yet been possible to establish a way of reliably breeding turtles indefinitely in captivity. Cayman Turtle Farm, which has been active in this field for longest, has experienced problems, probably with the nutrition of its farm-reared turtles, that have reduced the fertility of the turtles hatched from wild-collected eggs and have so far prevented any turtle conceived in captivity from breeding successfully at all. It is possible that further research may enable this obstacle to be overcome. However, the desirability of establishing closed-cycle breeding operations needs questioning, because, although it may have no direct detrimental effect on wild turtle populations, it also has no direct beneficial effect. By definition, it can function independently of wild turtle populations, and it can therefore take place where there are no wild turtles, as is virtually the case on the Cayman Islands. Other exploitation schemes which rely on having a large supply of wild turtles may provide a greater incentive to preserve a healthy wild population. The next category of exploitation, ranching, is of such a type.

Ranching

Ranching involves the removal of eggs or young turtles from the wild, and rearing them in captivity for the remainder of their life. Egg collection precedes the period of very high mortality which is thought to afflict hatchlings during their first few days of life, and thereby increases the number of larger turtles which can be obtained from a given number of eggs. It is preferable to captive-breeding on conservation grounds because it necessitates the retention of a wild turtle population as a source of stock, but has the disadvantage of having to take some, albeit few, turtles which

might otherwise have survived to breed in the wild. Some ranches, and indeed captive-breeding operations, have attempted to offset this by releasing young or partly grown turtles, but both techniques are viewed with suspicion, their efficacy for contributing to turtle breeding success being at best unproven. This uncertainty led Ehrenfeld (1982) to dismiss ranching as otherwise "entirely detrimental to conservation". However, Mrosovsky (1983) has pointed out that by only using "doomed eggs" (e.g. those laid below mean high tide level) there is no reduction in adult recruitment, and that if additional eggs can be transplanted to safer locations, the recruitment can even be increased.

One general problem with ranching, as opposed to captive-breeding, operations is that they have a finite limitation on their size. Much of Western economic philosophy relies on growth, and corporate financial planning usually involves an increase in turnover. With a captive-breeding enterprise, it is possible to increase turnover simply by increasing the breeding stock, but a ranch is limited by the size of the wild population which, if nesting is already at capacity, cannot increase. As a ranch begins to achieve economic success, there are likely to be demands to increase the intake of hatchlings; the level of government commitment to conservation must be high to resist these demands.

Subsistence and commercial exploitation

Much emphasis has in the past been laid on the distinction between hunting of turtles for subsistence or commercial purposes; and between domestic trade and international trade. Superficially, these seem pointless distinctions, partially because it is often difficult to distinguish between subsistence and commercial hunting (Frazier, 1980a), and it makes little difference to a turtle whether it is killed by a subsistence hunter or a commercial exporter. Similarly a turtle population will suffer equally from the subsistence harvest of 100 turtles as from the export of calipee from 100 turtles. But here, differences of absolute size become important. A subsistence harvest is limited by the needs of the people who have direct access to the harvest. In many Pacific nations, particularly the Solomon Islands and Papua New Guinea, the coastal human population may be quite large and growing fast, but population growth and economic development are universally associated with urbanisation. This creates a new market of traditional turtle eaters now living in cities and the only way in which they can be supplied with turtle meat is by commercial trade. Commercial trade can also open up non-traditional markets for turtle products amongst people living away from the coast, thereby further increasing the demand. The significance of international trade now becomes obvious, as it opens up the whole world as a potential market. Furthermore, many countries with large remaining turtle populations have no tradition of turtle consumption, possibly for religious reasons. International trade is a long-range way of breaking down traditional practices, and explains the tremendous, if short-term, expansion in turtle hunting in countries such as Yemen (PDR) and Somalia.

Commercial trade has a further insidious effect on the scale of turtle hunting: commerce implies profits, and profitability depends on scale. Once set up, a commercial company must function at a certain level in order to supply its employees with a living, and this means that markets must be developed if they do not exist already. International trade involves greater distribution costs and therefore can require higher trade volumes to permit similar profitability. If a ship is sent to a remote island to

collect turtles, it must return with a larger cargo than would be collected if it were merely necessary to drive a lorry on the local beach. If a mixed cargo is possible (including such commodities as copra, guano or bêche de mer) then the turtles need only comprise a small percentage of the whole cargo, but still more distant journeys might be made profitable. The problems of scale were clearly shown by the example of the turtle cannery, set up in the Cayman Islands in 1952, which had to close because it could not attain a high enough trade volume to reach its break-even point (Parsons, 1962), and that of a similar venture set up in Somalia in the early 1960s, which demanded a great expansion in the range of turtle fishing up the Somali coast (Travis, 1967).

These examples help to demonstrate the deleterious effects of commercial trade on turtle populations, and many of the recorded dramatic declines have been correlated with the onset of commercial turtle hunting (King, 1982). Conversely, subsistence hunting has infrequently been blamed for causing similar declines, but this "negative evidence" requires cautious assessment: it is self-evident that subsistence hunting is seldom adequately documented, and its long-term history is almost never known. Consequently it is not surprising that there is no documented decline of a turtle population caused by subsistence hunting. It may be that there are no large turtle populations left to decline in countries with a long history of turtle hunting and that this is reflected in the present distribution of breeding populations.

Implementing conservation strategies

The World Conservation Strategy, published in 1980, attempted to synthesise what was meant by conservation and what was needed to be done to achieve it. It recognised that natural resources always have been, always will be and, indeed, always must be exploited to ensure the survival of the human population. There is thus no need to justify the use of natural resources: this is as much a part of conservation as the setting up of nature reserves. What must be avoided is the abuse of natural resources. In the case of sea turtles, history shows that this has seldom, if ever, been achieved, and that few turtle populations have survived long-term exploitation without serious population declines and some have even become extinct. Turtle harvests are clearly not self-regulating and there is therefore a need to implement some form of conservation measures.

Obtaining the political will for turtle conservation is a problem which has exercised much discussion. Many people would instinctively be horrified at the possibility of the extinction of turtles, but it is often argued (see Mrosovsky, 1983) that aesthetic reasons alone are not enough to persuade a poor country to implement costly conservation measures or forgo a valuable turtle harvest. The potential value of obtaining a sustainable harvest from managed turtle populations has been used as one of the main bargaining points in arguing for turtle conservation. If this argument is to be used, then it must be possible to define a harvest and management regime compatible with conservation. If this cannot be done, and the only management strategy that can be recommended is one of total protection, then other arguments must be found for dissuading countries from depleting their turtle populations. Ehrenfeld (1976) argued strongly that utilitarian arguments for conservation were insufficient, and that more emphasis should be laid on non-utilitarian motives, although others have questioned the value of such arguments in developing countries not imbued with a conservation ethic. Reichart (1982) made this point forcibly:

"preservationists in the industrial nations should clearly understand that without an economic incentive, the people in the lesser developed areas of the world cannot be persuaded to care about conservation". Such an attitude can be attacked on the grounds that it is intellectually snobbish: "I think it is very wrong also to assume the superior attitude that peoples in poor countries are incapable of having or acquiring moral feelings of conservation" (Ehrenfeld, 1982).

Leaving aside for the moment the moral questions of whether to use a utilitarian argument for conservation, there is also the practical question of whether it is a sound argument. Turtle harvests can be supported on the grounds that they provide a source of protein, that they are commercially valuable or that they are culturally important. Probably the most intensive consumption of turtle meat is found in southern Bali, where the bulk of the Indonesian turtle harvest is sold and consumed. Some 17 088 C. mydas were landed at the ports in 1983, providing 400 t of meat, yet this is estimated to represent only 3% of the quantity of other meat (beef, pork and chicken) consumed in the region (Anon., 1984c). Egg harvests are the main food product of turtles in some countries, particularly Burma, Thailand and Malaysia. None of these countries harvests more than about half a million eggs a year, which is less than the output from one moderate-sized chicken farm. On a national scale, therefore, turtles nowhere make a significant contribution to the intake of animal protein, although they clearly have a greater importance to coastal peoples in some restricted localities, such as the Torres Strait Islands (Nietschmann, 1984).

The commercial value of the catch, either in direct income or in the cost saved by not having to buy other meat, may be of greater significance, particularly if products can be exported, thereby earning valuable foreign exchange. But, as Ehrenfeld (1976) has pointed out, commercial arguments have a dangerous habit of backfiring: turtle conservation is often justified on the grounds that, in the long term, it will be more profitable than over-exploitation leading to extinction, but the danger is that if over-exploitation proves to be more immediately profitable, then it is the policy that would be chosen on commercial grounds. Simplistically it would appear that an indefinite, sustained harvest at a reduced level must always be preferable to a short-term, finite but higher harvest. However, Clark (1973) demonstrated cases in which this was not true. Effectively he examined the commercial merits of two options: that of harvesting the entire population immediately, selling the catch, banking the proceeds and living off the income from this investment; or of deriving an annual income from a low-level, sustainable harvest. For slow maturing species, such as whales, the sustainable harvest is too low to outweigh the interest obtainable from an immediate, destructive harvest of the entire population. A management policy designed to maximise the commercial returns would lead to the rapid extinction of the species, and Clark drew confirmation for this theory from the sorry history of over-exploitation in the whaling industry. It would come as no surprise if the harvest of adult turtles, which are even slower to mature than large whales, were to fall into the same category and would lead to extinction if managed on commercial grounds. However, the harvest of turtle eggs has often been suggested as a good method of sustainable exploitation and a way of producing more protein than can be supplied by the harvest of adults (Hendrickson 1958; Mrosovsky, 1983). Nevertheless, preliminary calculations suggest that even egg harvests yield a low return if managed on a sustainable basis, and that extinction may result from unrestrained commercial exploitation in the same way as with the harvest of adult turtles. Carr (1969) foresaw this conclusion when he stated:

"rationally and cooperatively managed throughout the range of each nesting population Chelonia can be kept on a permanent basis as a stable source of protein food for the people of the seaside tropics. Left to the tender mercies of industry, however, it will everywhere disappear, as in the Caribbean it is disappearing now". Review of the status of Green Turtle and Hawksbill populations, and of marine turtles generally, suggests that substantial turtle populations are likely to persist "on a permanent basis" only where there is no tradition of exploitation, or where the infrastructure exists to enforce restrictions on exploitation or the protection of nesting beaches and foraging grounds.

INTERNATIONAL TRADE

The early history of international trade in Green and Hawksbill turtles has been documented by Parsons (1962) and Parsons (1972) respectively. Hawksbill turtles are traded primarily for their shell, which is known as "tortoiseshell", and there has never been a significant international trade for other products from the species. Usually the dorsal scutes are removed from the carapace and tied in bundles for transport to be used as the raw material for a variety of carving industries. Recently there has been a growing trade in whole, stuffed turtles. It is mainly the smaller turtles that are used for this purpose as the larger animals have thicker scutes which are more valuable for carving.

In the 19th and 20th centuries, the main markets for Hawksbill shell were in Europe and North America, where they were used for items such as combs, brushes, spectacle frames and other luxury goods. With the advent of plastics, the need to use tortoiseshell for utilitarian purposes declined, although it retained a place at the high end of the luxury market. The dropping demand seems to have been reflected in a falling price, which is well illustrated by the value of shell exported from the Seychelles. In the 1890s, tortoiseshell was worth about Rs30-40 a kg. The value rose to Rs51 in 1924, before declining to less than Rs10 a kg in the 1950s. A slight rise was apparent in the 1960s, which increased in pace until the price reached Rs818 a kg in 1982. This rapidly increasing price (although it is not corrected for inflation) is almost exactly mirrored by the volume of tortoiseshell imported to Japan. Mack et al. (1982) and later Weber et al. (1983) and Canin and Luxmoore (1985) examined the world trade in tortoiseshell, using primarily Customs reports, and concluded that Japan now accounts for the bulk of the market. Other Eastern countries, notably Hong Kong, China, Taiwan and the Republic of Korea are also shown by Customs statistics to be major importers of "raw tortoiseshell", but it is now thought that this broad Customs commodity classification may include substantial quantities of other material, such as freshwater turtle shell, which is used for medicinal purposes in the Orient. Raw Hawksbill shell is almost certainly imported to Taiwan and the Republic of Korea, but it is not possible from the Customs reports to determine in what quantities. Japan's Customs statistics, on the other hand, have been shown by independent analysis to be extremely reliable, not only in separating the shell of E. imbricata from that of other Testudinata, but also in overall volume and in the source of the imports (Milliken and Tokunaga, 1987a). It was concluded that in 1986, Japan imported the raw shell from about 26 000 large E. imbricata and about 8 000 small, stuffed E. imbricata. Other countries in the Far East, notably Republic of Korea and Taiwan, are believed to be major importers of raw Hawksbill shell and both export worked products. Fiji also has a substantial trade in worked shell.

INTRODUCTION

The European trade in E. imbricata shell is now insignificant in terms of global volume, although it reveals some serious lapses in CITES implementation. The main use for raw shell is in the manufacture of luxury spectacle frames. At least two companies in F.R. Germany were making spectacles from "pre-Convention" shell imported from Caribbean countries, and the French Management Authority issued import permits for nearly quarter of a tonne of tortoiseshell for this purpose in 1985. Some stuffed Hawksbills sold in marine curio shops in Switzerland, France and possibly other countries, are believed to have been imported in shipments of mixed sea shells from the Far East.

Other countries have little commercial trade in Hawksbill shell products but are significant sources of curios which visiting tourists may export on their return to their home countries. Although the quantities of shell in the individual items may be small, they may add up to a substantial export over the year. Notable sources of tourist items are the Seychelles, Madagascar and a variety of Pacific islands.

Green turtles are used chiefly for edible products, and have been exported in the form of live animals, frozen meat and dried calipee. Parsons (1962) estimated that in 1878 some 15 000 C. mydas were imported to England, mainly from the Caribbean. In the 20th century, the trade turned more to frozen turtle meat and dried calipee, which was used in soup manufacture. The chief sources were the Caribbean and the Indian Ocean, particularly the Seychelles, Kenya and Aden (now PDR Yemen). The USA also imported substantial quantities of C. mydas products from a variety of Caribbean and Latin American countries, reaching some 200 t in 1974 (Cato et al., 1978). There is very little evidence of continuing international trade in C. mydas meat, and this is probably mostly attributable to the effects of CITES. Imports to the USA have all but ceased; a little soup is still manufactured in Europe, mostly the UK and France, using meat from the Cayman Turtle Farm and the ranch on Réunion; 7 t of meat were exported from Indonesia to Japan in 1984, but this is not thought to have been repeated. Most of the effective international movement of turtles for human consumption now occurs at the fishing-boat level: boats fishing off Costa Rica are known to land some of their catches in San Andres (Colombia); Cayman Island fishermen catch turtles off Nicaragua; and Venezuelan boats sell turtles in the Netherlands Antilles.

The other main product of C. mydas is leather, although it is not so sought after as the leather of L. olivacea. Formerly most of the turtle skin was tanned in Italy and France, but as both countries had reservations on C. mydas, they did not generally report trade in their CITES Annual Reports and it is difficult to determine the volume of trade. The skins came chiefly from Mexico and Indonesia; some were also declared as having originated in Ecuador, but these are thought to have been almost entirely skins of L. olivacea. Japan has been the other main importer of turtle skin and tanned leather, the latter mostly originating in Mexico and the former in Indonesia, Ecuador and, sporadically, Pakistan and Panama. Of this, the material from Ecuador was mostly L. olivacea; that from Mexico a mixture of this species and C. mydas; and from the other countries, mostly C. mydas.

The trade in turtle leather is a relatively recent development. In some regions it is merely a by-product of the turtle meat industry, but in others it provides the primary incentive for the turtle harvest. During the 1960s, carcasses of many of the enormous numbers of turtles caught off the Pacific coast of Mexico were left to rot once the skin had been removed. In

Pakistan, turtles are not generally eaten, and the only reported substantial commercial exports have been of skins. Turtle skin imports to Japan from Indonesia grew steadily from 1977 to a peak of over 20 t in 1982. This pattern of trade is in marked contrast to the trade in tortoiseshell, which reached a peak in 1979, thought to be a reaction to the entry into force of CITES in Indonesia in that year. It has been reported that the export of skins continued at a high level after accession to CITES because the exporters were unaware that skin exports were covered by the Convention. This oversight has been corrected recently, which may account for the declining levels of imports to Japan. Exports of turtle leather to Italy and France are said to have become very difficult owing to the imposition of European import controls (Schulz, 1987). Although the leather trade is run as an adjunct to the turtle meat trade in Bali, it is economically important because the sale of meat alone barely covers the cost of buying large turtles. Under these conditions, the export of leather is essential to maintain the profitability of killing turtles for meat (Anon., 1984c).

The raw shell of wild Green Turtles is almost worthless. It has in the past been used in marquetry, but it is too thin to be carved, and has few commercial uses. Very small quantities are used in Japan for making the sails of model "treasure ships" (Milliken and Tokunaga, 1987), and some is used to make decorative objects such as lampshades. The shell of farm-reared turtles is much thicker, probably as a result of the high protein diet that they are fed. Shell produced by both Cayman Turtle Farm and the ranch on Réunion has been claimed to be comparable in quality to E. imbricata and can be carved into substantial ornaments. However, Japanese bekko manufacturers confirm that it is no substitute (Milliken and Tokunaga, 1987) and the French group of spectacle manufacturers made a similar declaration (Le Serrec, 1988).

The only significant international trade in shell of C. mydas is in stuffed turtles or polished carapaces. The average size of stuffed C. mydas in trade is higher than that of E. imbricata (because the large Hawksbills are normally used for tortoiseshell), and Milliken and Tokunaga (1987) estimated that the 11.4 t imported to Japan in 1986 represented the shells of some 5 000 turtles.

Turtle oil, most of which comes from C. mydas, has been traded internationally for the cosmetics industry. Between 1910 and 1940, the Seychelles exported a total of nearly 25 t of this product, most of which probably went to Europe. Turtle oil is widely used locally for medicinal remedies and for waterproofing boats in the Indian Ocean. Although there is little reported evidence of a continuing international trade in the wild product, exploitation certainly continues: oil from the many thousands of C. mydas taken on beaches in Baluchistan (Pakistan) in recent years reportedly was used in nearby Oman (Groombridge et al., 1988). Farm-reared turtles produce considerably more fat than wild turtles of a comparable size, and most of the turtle oil in trade probably derives from Cayman Turtle Farm and the Réunion ranch. Between 1977 and 1983, CTF exported a total of 11.7 t of oil, mostly to France, the UK and Japan.

Turtle eggs are sold in many parts of the world, but there appears to be little international trade except in South East Asia. The bulk of this trade involves imports to Sabah and Sarawak, the former mostly from the Philippines and the latter mostly from Indonesia. Exports of eggs to Sarawak provide the primary commercial incentive for egg collection in the Indonesian islands of S. Natuna and Tambelan, and there is apparently little attempt to control this trade.

Although in global terms, the bulk of the trade in turtle products occurs in commercial shipments, large quantities are taken across international boundaries as personal possessions and tourist souvenirs. This applies particularly to polished shells, jewellery and leather goods. In most cases this trade goes unrecorded, but CITES Reports contain some indication of the countries from which such souvenirs are obtained. In some countries, such as Australia and many Pacific Islands, the sale of curios from turtles provides the only commercial incentive for killing turtles, and so this form of trade may be locally more important than its low volume might imply.

The effect of CITES on international trade

Since the inception of CITES, sea turtles have been accorded increasing levels of protection under the Convention, culminating in the inclusion of the entire family of Cheloniidae in Appendix I in 1981. The salient features of the timetable of sea turtle conservation under CITES are summarised in Table 6. Although trade in sea turtles has undoubtedly decreased as a result of the provisions of the Convention, turtle products are probably traded in greater quantities than any other commodities supposedly protected under Appendix I. Some of this trade may be legal, but undoubtedly a large percentage contravenes the Convention.

Table 6. Timetable of events relating to the implementation of CITES with respect to _C. mydas_ and _E. imbricata_. Where votes were taken the results are given in brackets (For/Against/Abstain).

1973	Washington Convention.
1975	CITES came into force. _E. imbricata imbricata_ (Atlantic Hawksbill) on Appendix I. _E. imbricata bissa_ (Pacific Hawksbill) on Appendix II. _C. mydas_ (Green Turtle) on Appendix II.
1976	1st Meeting of the Conference of the Parties to CITES, Berne. Adoption of the "Berne Criteria" for the inclusion or deletion of species from CITES Appendices. UK ratifies CITES.
1977	_E. imbricata bissa_ transferred to Appendix I. Australian population of _C. mydas_ retained on Appendix II, but the remainder of the species transferred to Appendix I.
1978	France accepts CITES, but takes reservations on _E. imbricata_ and _C. mydas_. Indonesia accedes to CITES.
1979	2nd Meeting of the Conference of the Parties to CITES, San José. Conf. 2.12 defines the meaning of "bred in captivity". Cayman Islands included in UK ratification of CITES (8 May).
1980	Japan accepts CITES, but takes reservations on _L. olivacea_, _E. imbricata_ and _C. mydas_.
1981	3rd Meeting of the Conference of the Parties to CITES, New Delhi. All Cheloniidae transferred to Appendix I. Conf. 3.15 sets up a procedure for transferring ranched populations to Appendix II. Suriname accedes to CITES, but takes reservations on _D. coriacea_ and _C. mydas_.
1983	4th Meeting of the Conference of the Parties to CITES, Botswana. Conf. 4.15 establishes the need for captive-breeding operations to be registered with the CITES Secretariat. UK Proposal to allow limited trade in captive-bred specimens of species which take longer than 3 years to reach maturity. Discussed

Table 6, continued.

	in Committee but WITHDRAWN and referred back to TEC.
	French Proposal to transfer ranched populations of C. mydas on Europa and Tromelin to Appendix II. WITHDRAWN.
	Suriname Proposal to transfer ranched population of C. mydas to Appendix II. REJECTED, but APPROVAL (43/3) committed conditional on a satisfactory marking system being approved by T.E.C.
1984	1st Meeting of CITES Technical Expert Committee.
	Suriname submits revised marking system. APPROVED (31/0).
	France presents new ranching proposal.
	France and Italy withdraw reservations on C. mydas and E. imbricata.
1985	5th Meeting of the Conference of the Parties to CITES, Buenos Aires.
	Conf. 5.16 strengthens the control of trade in ranched specimens.
	Suriname Proposal to transfer ranched population of C. mydas to Appendix II. REJECTED (26/22/15).
	French Proposal to transfer ranched populations of C. mydas on Europa and Tromelin to Appendix II. REJECTED (25/32/7).
	UK Proposal to transfer ranched population of C. mydas in Cayman Islands Turtle Farm to Appendix II. REJECTED (27/32/7).
	UK submits a special resolution to treat the offspring of turtles acquired by Cayman Turtle Farm before 1979 as pre-convention. REJECTED (26/32/4).
	Indonesia Proposal to transfer population of C. mydas to Appendix II. REJECTED (2/23).
	Indonesia Proposal to transfer population of E. imbricata to Appendix II. REJECTED (3/27).
	Seychelles Proposal to transfer population of E. imbricata to Appendix II. REJECTED (33/17/4).
1986	2nd Meeting of CITES Technical Expert Committee.
	France submits revised marking system. APPROVED.
1987	6th Meeting of the Conference of the Parties to CITES, Ottawa.
	French Proposal to transfer ranched populations of C. mydas on Europa and Tromelin to Appendix II. REJECTED.
	Indonesia Proposal to transfer population of C. mydas to Appendix II. WITHDRAWN.
	Indonesia Proposal to transfer population of E. imbricata to Appendix II. WITHDRAWN.
	Conf. 6.21 establishes the need for captive breeding operations to adopt a system for marking their products and provide a mechanism for removing from the register of approved operations those which fail to maintain the required standards.
	Conf. 6.22 requires that Parties having ranching operations under their jurisdiction should submit annual reports of their status and provides a mechanism for transferring ranched populations back to Appendix I should they fail to maintain the required standards.
	Conf. 6.23 calls on IUCN to convene a meeting of specialists to draw up guidelines on evaluating marine turtle ranching proposals for submission to the CITES Secretariat.
	Japan withdraws reservation on C. mydas (retains those on E. imbricata and L. olivacea)
1988	IUCN workshop to establish guidelines for evaluating marine turtle ranching proposals, Costa Rica.
1989	St Vincent and the Grenadines accedes to CITES with a reservation on E. imbricata.

INTRODUCTION

Very large quantities of turtle meat, shell and leather products were formerly imported to Europe and North America. The implementation of CITES is at least partially responsible for the fact that this trade has now dropped to low levels. Particularly important in this respect has been the uniform implementation of CITES by the EEC countries which has forced France and Italy to withdraw their reservations on sea turtles. The curtailing of international trade in turtle meat has meant that there is little threat to C. mydas populations from international trade, the major problem being commercial domestic trade. However there are several important exceptions to this general rule: the export of leather from Mexico, Panama and Indonesia; the export of eggs from Indonesia and the Philippines; and the export of stuffed turtles from Indonesia in commercial quantities and as tourist souvenirs from a variety of countries.

International trade in the shell of E. imbricata still gives considerable cause for concern. Although the imports to Europe and North America have been reduced to virtual insignificance, largely by the implementation of CITES, the trade in the Far East may well account for more Hawksbills annually than were ever consumed by the traditional western markets. The principal importer is Japan, and Figure 1 illustrates how imports of bekko fluctuated over the years from 1950 to 1970. Historical levels of trade are hard to determine and although Figure 1 appears to show a marked increase from 1950 to 1973, the huge imports recorded in 1954 meant that the average annual import in the 1950s was 32.5 t, similar to the 31.5 t in the 1960s although much lower than the 44.7 t recorded during the 1970s. The most obvious effects of CITES on this trade were the twin import peaks in 1973 and 1979 associated, respectively, with the Washington Convention and the acceptance by Japan of the Convention. It is true that Japan imposed, and has more or less adhered to, an import quota of 30 t of raw bekko a year, slightly lower than the average imports in the 1950s and 1960s, but it is not known how this compares with the level of trade that had traditionally been carried out prior to the 1950s.

Although Japan has a reservation on E. imbricata, it has an obligation under CITES Resolution Conf. 4.25 to ensure that imports are accompanied by a permit issued by the competent authority in the exporting country. Such permits should not have been issued by countries party to CITES. Prior to 1980, when Japan accepted CITES, the countries party at that time had supplied about 55% of the imports of bekko, but this percentage dropped slightly to around 45% in the early 1980s. However, in 1983, 44% of imports of bekko were obtained from Parties. A marked change was apparent by 1986, when only 18% of bekko was obtained from Parties, and increasing quantities were imported from non-Parties, particularly Cuba, Haiti, Jamaica, the Maldives, the Solomon Islands and Singapore. Bekko traders have now decided not to import from Party states, and there was no such import in 1988 (Kaneko, in litt., 10 March 1989). Thus, although CITES has not caused Japan to curtail its imports, it has forced it to look to alternative suppliers. A note of caution should be sounded here, because some of the shell from the new suppliers almost certainly represents turtles from the same populations that were previously exploited by the old exporters. For instance, the imports from Singapore are of shell from Indonesia, and much of the Caribbean trade will simply have been re-routed. However, concern has been expressed that Japan's attempts to comply with CITES has resulted in an increase in overall exploitation in the Caribbean.

The other way of examining the impact of CITES on the Japanese import figures is from the point of view of the exporters. Table 7 shows the quantities of bekko imported to Japan from different countries in relation to the year in which they joined CITES. In many cases, the year of joining

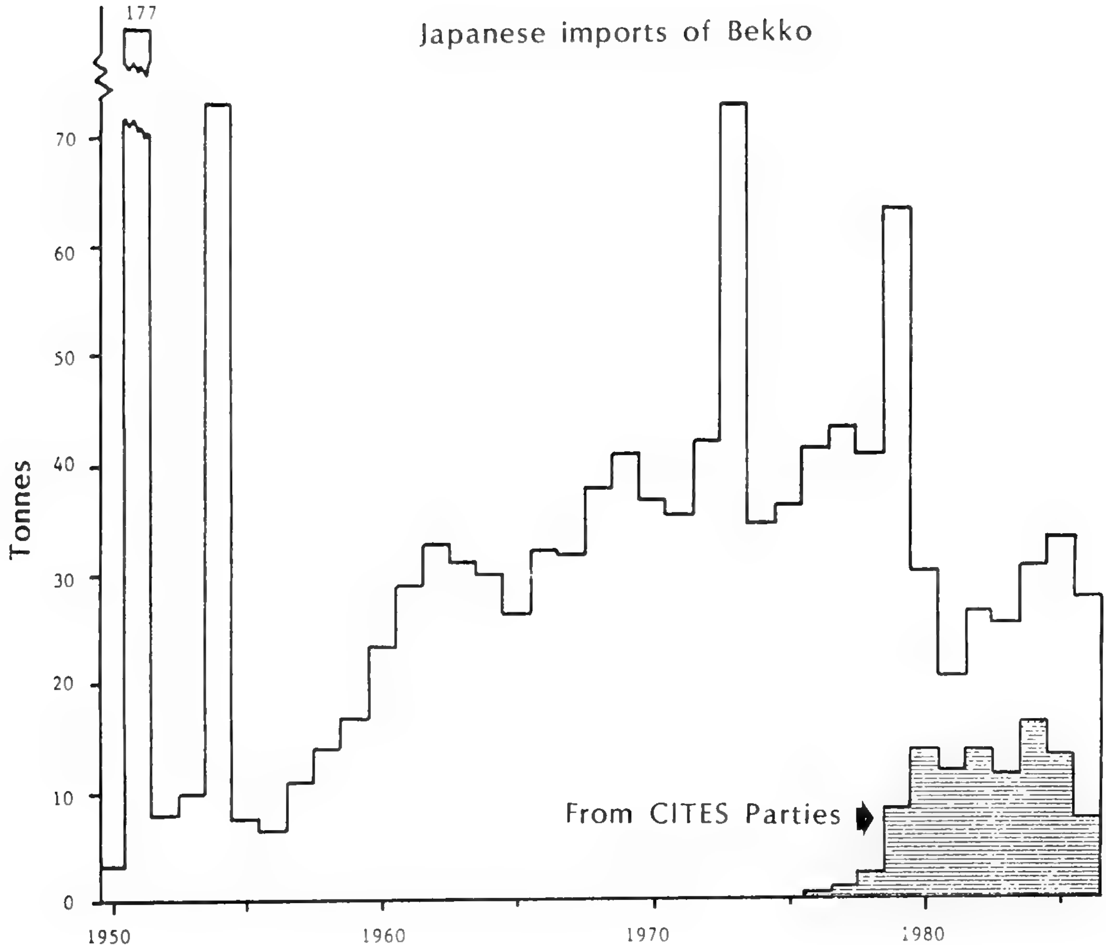

Figure 1. Imports of unworked tortoiseshell (before 1962) and unworked Bekko (after 1962) recorded in Japanese Customs statistics in tonnes.

Table 7. Quantities of bekko reported to have been imported in Japanese Customs statistics from CITES Parties in relation to the year in which CITES came into force in the exporting country (kg).

	Years before joining CITES								Years after joining CITES										
	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11
Canada	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	-	-	-	-
Costa Rica	381	418	360	189	387	265	175	515	170	260	47	89	-	234	79	5	-	-	-
Madagascar	-	-	64	-	250	570	100	100	60	-	-	-	-	-	-	-	-	-	138
Puerto Rico	77	585	974	700	498	341	45	165	262	264	-	18	-	-	-	-	-	-	-
USA	-	-	-	153	-	6	-	-	-	-	-	-	-	-	-	22	-	-	-
Australia	1657	1654	894	-	397	364	977	1087	192	-	-	-	-	-	-	-	-	-	-
Belize	-	97	82	-	28	279	-	12	40	-	314	258	-	702	538	-	1195	2231	
F.R. Germany	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	226	-	-	
Hong Kong	-	-	39	968	2124	15	243	-	163	89	945	-	104	-	-	-	-	-	
India	-	591	769	244	1193	74	150	194	68	20	-	-	-	-	-	-	-	-	
PNG	344	-	-	-	181	-	-	-	-	-	-	-	-	-	-	-	-	-	
UK	-	-	-	10	234	149	86	209	-	-	-	-	-	-	-	-	-	-	
Nicaragua	789	1060	1316	994	2646	1632	1446	1573	1014	949	7	475	417	-	12469	192	-		
Seychelles	449	275	-	-	136	177	106	523	976	1027	618	423	472	675	629	61	-		
France	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-			
French W Indies	-	-	-	-	122	152	198	276	123	196	231	215	-	-	-	-			
Malaysia	1106	108	56	-	-	-	45	-	-	-	-	196	349	74	-	-			
Panama	11981	8389	8990	9350	9313	5885	4450	6505	4810	3360	3011	2243	3889	4259	1500	-			
Réunion	-	-	-	-	-	377	-	-	-	-	-	-	-	-	-	-			
Venezuela	-	-	171	-	-	-	-	-	-	-	-	-	-	-	-	9			
Bahamas	1474	580	218	449	532	922	1018	1886	767	29	728	-	-	-	-				
Caymans	78	936	963	1083	3096	3863	6321	6110	2505	3022	2258	-	115	-	-				
Indonesia	7197	20302	2693	4328	6464	10114	5659	19071	4811	1579	2032	3605	6604	5534	1740				
Kenya	183	1744	84	1169	2654	2655	2850	2051	463	1404	572	938	2111	3110	400				
Sri Lanka	-	-	-	-	-	-	-	-	46	-	-	17	-	-	-				
Tanzania	2356	1688	1719	2152	1474	1410	5943	1202	845	836	168	540	1032	133					
Colombia	58	45	-	-	-	-	-	-	-	-	-	-	-						
Mozambique	-	-	277	-	-	-	-	-	-	-	-	-	-						
Philippines	4621	1288	2369	3313	1416	3539	2514	1439	1376	232	1227	276	-						
Portugal	-	-	55	88	-	-	-	-	-	-	-	-	459						
Saint Lucia	-	489	349	152	143	267	270	362	-	-	-								
Belgium	-	-	-	-	203	-	-	-	-	-									
Netherlands	1017	1288	3549	1305	448	-	1077	-	-	-									
Trinidad	-	-	-	-	-	-	329	544	208	-									
Honduras	9	9	1132	481	636	1886	2463	2217	-										
Total	35629	44067	27345	27414	34918	35625	36593	46600	19612	13686	13657	10002	16026	14891	19577	515	1195	2231	138

CITES or the preceding year was marked by an increase in the levels of exports. For most countries, the exports in subsequent years dropped to low levels, and in many cases to zero. The chief countries which continued to export bekko after joining CITES were Indonesia, Panama, Nicaragua, Kenya, Tanzania, Belize and the Philippines, although it is fair to say that many of these countries have improved recently. The main sources of bekko amongst CITES Parties in 1986 were Belize and Indonesia. Belize is of particular concern, not only because imports from there increased markedly in 1985 and 1986, but also because the examination of the Japanese dealers reports indicate that the Customs statistics have underestimated the trade (Milliken and Tokunaga, 1987).

Curbing the trade in the shell of E. imbricata must be seen as the most important problem facing CITES in relation to sea turtle conservation. In some cases, improvements could be achieved by persuading the exporters to accede to CITES if they are not already Parties, or to implement the Convention better if they are. However, this may simply result in the diversion of the trade routes without significantly reducing the volume. The greatest hope for advance lies in persuading Japan to reduce its imports. Much emphasis has been laid on the long tradition of carving bekko in Japan, and the cultural impoverishment that would result if this trade were stopped. However, the recent increase in levels of trade shows that although the carving industry is traditional, the market is not, and much effort has been devoted to developing a fashion market for bekko jewellery amongst the younger consumers (Stewart-Smith, 1987).

Ranching and international trade

One of the most contentious aspects of proposals to allow trade in captive-bred or ranched turtles has been the effect that this will have on trade in wild turtle products. It is widely acknowledged that trade in wild products constitutes a major threat to the survival of wild populations, and should therefore be controlled, but the means of doing so are in dispute. On the one hand, it is argued that the ability to supply turtle products from a well-managed rearing operation will both displace the trade in wild products and make its control easier, while on the other, that legal trade will stimulate demand and will make the control of illegal trade more difficult. Unfortunately there is very little evidence to enable the objective assessment of these two diametrically opposed views, and this probably accounts for the heat with which they are debated (see Weber et al., 1983; Mrosovsky, 1983).

For a ranched product to be able to displace a wild product from trade by market forces it must be available in a large quantity relative to the wild supply and must be more attractive, either by being cheaper or of a better quality. Neither of these conditions is likely to be met in the early stages of a ranch, when the supply is small and the development costs are still high; however, at later stages they may well be fulfilled. A good example is the farming of Atlantic Salmon (Salmo salar) in Europe, 15 years ago dismissed as impractical, but now producing 60 000 t a year, many times the volume of the wild catch, and at barely half the cost per kg. It is far from certain that the same will be possible with turtles, indeed evidence from the commercial failure of the Torres Strait ranches suggests that it may not, but it should not be dismissed out of hand.

The converse argument, that of stimulating trade in wild products, is also difficult to demonstrate. The marketing of farmed turtle products often requires the development of new outlets but, contrary to what is often

suggested (e.g. Dodd, 1982), this is not in itself a threat to wild turtles unless it also draws wild turtle products into the newly created market. Lacking firm examples of this, it is difficult usefully to contribute further to the argument, but it is probably safe to conclude that diversion of trade is unlikely to occur in the early years of a ranching operation, though it may occur later, while stimulation of trade is possible but unproven.

A closely related question is whether the provision of legal supplies of turtle products makes it more or less difficult to control the trade in similar illegal commodities. On the face of it, it might seem obvious that it is administratively easier to prohibit sales altogether than to allow sales of ranched products while prohibiting the rest. However, if all trade is illegal, then it is forced underground whereupon it requires a major policing effort to detect, let alone prevent. Controlling trade in ranched products depends on the ability to distinguish them, and the problems of enforcement are still further confounded when international trade rather than simpler domestic trade is involved. For this reason, CITES resolutions demand strict methods to be adopted by exporting countries to mark all products of ranching operations so that the importers can distinguish them from wild-caught products. A problem may arise after raw materials, such as leather or meat, have been exported to a second country for manufacture into, say, handbags or soup and are subsequently re-exported. CITES does not demand that these be uniformly marked, and if the second (manufacturing) country also works with wild-caught raw materials, then the final importer will not be able to determine the origin of the manufactured goods. Control in this case depends on the efficiency with which the manufacturing country implements CITES to prevent the import of wild products, but if the country also has a legal supply of domestically produced wild products, then absolute control is impossible.

It is impossible to deny that the existence of legal supplies of turtle products can be, and is, regularly used to conceal illegal trade. A few examples of the problems of controlling CITES trade will serve to illustrate this. From 1979 to 1981, the only population of C. mydas on Appendix II was the Australian population, all others being on Appendix I. There is evidence that products of C. mydas were exported from Mexico with false documentation, indicating that they originated in Australia. This was an important factor in deciding to place the entire species (and family) on Appendix I (King, 1982). In 1984, Hong Kong's CITES Annual Report indicated the import of 1816 skins of C. mydas from Mexico, said to have originated in the Cayman Islands, although the latter has never reported exporting comparable quantities of skins to Mexico. It seems that the existence of Cayman Turtle Farm (although it does not comply with the definition of captive-bred in Resolution 2.12) may have been used as an excuse to justify exporting skins. The UK, probably implying the Cayman Islands, was also the declared origin of C. mydas soup exported from France to Australia and Japan in 1985, whereas there is independent evidence that the soup was manufactured, at least partially, from turtle meat from Réunion (Le Serrec, 1987), and there was no report of the export of meat from the Cayman Islands to France. Italy, like France, used to have a reservation on C. mydas but not on L. olivacea, and has reported exporting considerable quantities of skins and leather products of C. mydas, said to have originated in Ecuador. The commercial turtle harvest in Ecuador is almost entirely of L. olivacea, and so it seems that the specific identity may have been wrongly declared to comply with Italy's CITES reservations.

Thus, infractions of CITES certainly do occur, and the existence of Cayman Turtle Farm, and of other species of turtle traded in compliance with the CITES convention, have almost certainly been used to facilitate illegal trade. Whether this occurs on a large enough scale to outweigh the other advantages of having the trade conducted in the official eye is open to debate. It is noteworthy that all of the examples quoted above only came to light because they were recorded in CITES Annual Reports. If they had been conducted entirely underground we might never have known about them.

OTHER THREATS TO MARINE TURTLES

Throughout this report, emphasis has been laid on the deliberate hunting of sea turtles and trade in their products; however, it should be appreciated that other factors attributable to man's activities may have a similarly large, and often greater, impact on turtle populations. These factors, outlined below, include some which cause direct mortality and some causing disturbance and disruption of nesting behaviour.

Incidental catch

Incidental capture of turtles during other fishing activities is possibly the major form of direct mortality. Hillstead et al. (1982) reviewed incidental capture and concluded that shrimp trawling posed the major threat, probably because it is usually carried out in shallow, warm seas which are also the feeding areas used by most sea turtle species. Turtles are also caught on longlines, in seines and set nets. In the latter category, special mention should be made of large-mesh shark nets which are extensively used in the tropics. In some cases they may be set with the dual purpose of catching turtles and sharks.

Coastal development

Amongst the many effects of coastal development, disturbance of nesting beaches is the most obvious, as humans tend to favour the same kind of sand beaches for recreational purposes as turtles require for nesting. In some cases, the disturbance of nesting animals may be direct, where humans on the beach at night disturb the turtles. Examples of this have been reported from Malaysia and Oman. A more insidious form of disturbance is the installation of lights which deter females from emerging to nest and disorientate returning females and emerging hatchlings; this topic was reviewed by Raymond (1984). Some day-time activities, such as the erection of umbrellas and the compaction of sand by recreational vehicles or beach cleaning machinery, for example, may increase hatchling mortality. Typically, coastal development leads to all such factors operating simultaneously on the nesting population in question.

The spread of human settlement often increases the collection of eggs or capture of nesting females simply as a result of improved access to the beach. However, human settlement also brings domestic animals such as dogs and pigs which can cause heavy predation of nests (Stancyk, 1982).

Pollution

Frazier (1980b) reviewed the various marine pollutants which may affect sea turtles and found grounds for serious concern although little direct evidence of chemical pollution. Oil spills, being particularly obvious, are

one of the recorded causes of turtle mortality. Better documented is the physical impact of floating debris on sea turtles. This includes entanglement in discarded fishing net as well as ingestion of plastic refuse (Balazs, 1985c, Carr 1987b). Frazier (1980b) and Carr (1986, 1987a, 1987b) both pointed out that, during the pelagic phase, turtles tend to aggregate along the margins of currents and zones of mixing; features which cause the accumulation of floating debris and other pollutants as well as food items.

Other disturbances

Sand extraction is a widespread activity which can disrupt nesting beaches. Even if the nests are not destroyed, the removal of sand may so alter the beach as to make it unsuitable for nesting. Sand beaches are dynamic features, and so the removal of sand elsewhere or even sub-marine dredging may affect the morphology of a beach at a distance.

The feeding habitats of turtles are also susceptible to disturbance. In the case of Hawksbills, the coral reef environment is suffering damage from such diverse factors as increased sedimentation (caused often by deforestation on land), coral extraction, dynamite- or poison-fishing, variations in ocean temperatures, and chemical pollutants (see Wells, 1988a). The feeding habitat of adult C. mydas, mainly seagrass beds, may also be affected by some of these factors, especially sedimentation and dredging.

CONSERVATION STATUS

In 1620 the Bermuda Assembly prohibited the taking of young turtles up to 18 inches broad within five leagues of the islands (the penalty being a fine of 15 pounds of tobacco, to be shared between the informer and the community) (cited by Carr, 1952). This appears to be the first recorded recognition of the potential deleterious effects of heavy exploitation of sea turtles. In the present century, much concern has been expressed over the documented or suspected decline of sea turtle populations in many parts of the world; sea turtles have come to be widely regarded as threatened species, and appear in the protective legislation of many countries. The evidence for this assessment has been reviewed on several occasions; on a world basis by King (1982, C. mydas and E. imbricata), Ross (1979, and 1982, three other species), and Groombridge (1982, all species). In this report we attempt to provide a comprehensive survey of the status of populations of C. mydas and E. imbricata. The information given at greater length in the country accounts comprising the main body of the report is summarised in this section and in Table 8 (below).

Population status: summary tables

The following Tables summarise select population data derived from the country accounts forming the main body of this report. It must be recognised that their compilation necessitated considerable simplification of conditions that are complex and often poorly-known, and the making of numerous value-judgements, few of which might be universally agreed upon. The intention is simply to provide a broad perspective on world populations of the Chelonia mydas complex and Eretmochelys imbricata; these must be substantiated by reference to the country accounts.

The term "geopolitical units" includes all areas separately itemised in the country accounts; thus, for example, the Pacific and Gulf/Caribbean coasts

of Mexico are treated separately, as are mainland India and the island territories of India. Whilst this is intended to increase precision, and the number of such units will be closer to the total number of nesting populations than would the number of countries in which the species nest, considerable bias remains. All units are far from equivalent, and to state that populations appear to have declined on Cyprus, for example, has very different implications for C. mydas numbers than stating that populations in Indonesia are in decline. Nevertheless, given that these limitations are recognised, it is to be hoped that the figures give a useful broad basis for comparison.

Table 8. Summary of selected data on sea turtle populations.

	C. mydas	E. imbricata
1. Number of geopolitical units with breeding populations[1]	99 (148)	65 (123)
2. Indication of annual nesting numbers[2]	100 000-200 000	15 000-25 000 ?
3. Number of geopolitical units with major populations[3]	16 (23)	24 (26)
4. Number of geopolitical units with large and apparently stable populations:		
(a) not known to be significantly depleted[4]	8	?
(b) possibly depleted owing to past exploitation[5]	4	?
5. Number suspected to be depleted or in decline (exclusive of 6, below)	38	38
6. Number with decline well-substantiated (exclusive of 7, below)	29	18
7. Number of geopolitical units with breeding populations effectively extirpated[6]	7	none known

Note[1]: the upper figure indicates the number of units where some estimate can be attempted of relative nesting density, whether sparse and occasional, or heavy and regular (all those represented by "0/1" to "5" in columns 1 and 6 of Table 11). The lower figure (in parentheses) in addition takes account of all sites where nesting is certain but at an unknown level, or possible but unconfirmed (all those units represented by "?" in the Table cited). Whilst the great majority of "?" populations are likely to be small, a very few, eg. Eretmochelys in Madagascar, are suspected to be of regional or world importance. The number of "significant" populations will thus be greater than the upper figure but considerably less than the lower figure.

Note[2]: the "indication of total annual nesting numbers" is no more than an indication; these are order of magnitude approximations from the data available, not rigorously derived counts.

Note[3]: a "major" population here is, for C. mydas, one known or strongly suspected to have between 1000 and 5000 (or more) females nesting annually, and for E. imbricata, one with 100-500 (or more). Figures in parentheses include borderline populations.

Note[4]: for C. mydas these would include Galapagos, Suriname, Europa, Tromelin, Oman, New Caledonia (d'Entrecasteaux group), Queensland, Western Australia. Insufficient information is available for Eretmochelys to suggest which, if any, populations may fall into this category.

Note[5]: for C. mydas these would include Ascension, Costa Rica (Caribbean), Pakistan, Yemen (P.D.R.Y.). Insufficient information is available for Eretmochelys to suggest which, if any, populations may fall into this category.

Note[6]: Bermuda, Cayman Islands, Hong Kong, Israel, Mauritius, Rodrigues, Réunion.

Table 9. Number of geopolitical units with breeding populations falling into each size class, summarised from Table 11. ? = nesting certain or possible but no further data. For C. mydas, 1 = up to 250 females nesting annually, 2 = 250-1000, 3 = 1000-5000, 4 = 5000-10 000, 5 = more than 10 000. Numbers separated by oblique = population intermediate. For Eretmochelys, the numerical limits of classes 1-5 are an order of magnitude lower.

Size class	?	0/1	1	1/2	2	2/3	3	3/4	4	4/5	5
C. mydas	55	12	40	12	10	7	7	3	2	2	2
E. imbricata	60	10	9	12	9	2	14	4	3	0	2

The conservation status of the Green Turtle

Review of all available information, which is admittedly incomplete and of variable quality, suggests that on average between 100 000 and 200 000 female Green Turtles, possibly more but not fewer, are nesting annually at the present time. The annual nesting contingent is drawn from a pool of mature animals that is probably two to three times larger. Assuming an overall sex ratio at maturity near to equality, there will be a similar number of mature males, and the total adult Chelonia mydas population may number in the region of 1 000 000 individuals.

Around half of the extant nesting populations are either known or suspected to be depleted or in decline, but decline is well-substantiated in fewer than half of these. Seven nesting aggregations are known to have been effectively extirpated; all but one of these were small-island populations which disappeared after human colonisation. In virtually all cases, decline

is attributed largely or entirely to exploitation. For many populations, no information on trends in numbers is available.

It is certain that many present populations, whether or not they are thought to be depleted or in decline, are under considerable pressure from factors such as exploitation, incidental catch and habitat disturbance, operating together or alone, even though this may not yet be shown by a decline in nesting numbers. As stressed elsewhere (see Marine Turtle Biology and Management section), the phenomenon of delayed maturity in marine turtles, combined with the present inability to measure immature numbers and survivorship, means that recruitment to the breeding population may for many years be too low to ensure its perpetuation before a decline in the number of females on the nesting beach becomes apparent.

There are numerous populations with several thousand females nesting per season, some with many thousands. Whilst some have been affected by past exploitation, and may at present be affected by various adverse factors, a significant number appear not to be in decline, and a very few may be increasing owing to effective protection. Of course, number of individuals is far from being the only criterion by which degree of threat can be assessed, and a hundred large populations all declining at the same rate will become extinct just as inevitably as would a single large population.

Table 10. Summary of "major" populations, in the case of C. mydas, with more than 1000 females nesting annually, in the case of E. imbricata, with more than 100.

Chelonia mydas

Class 3 (1000-5000): Ascension, Comores, Ecuador: Galapagos, Seychelles, Suriname, Pakistan, Phillipines. Note should also be taken of the following "borderline" populations, and those of uncertain size but probably within this range: Equatorial Guinea: Bioko (?), Malaysia: West, Malaysia: Sabah, Maldives, Mexico: Pacific, Papua New Guinea, Réunion: Tromelin.

Class 3/4: New Caledonia (?), Réunion: Europa, Somalia (?).

Class 4 (5000-10 000): Western Australia, Oman.

Class 4/5: Yemen (PDR), Costa Rica.

Class 5 (more than 10 000): Queensland, Indonesia.

Eretmochelys imbricata

Class 3 (100-500): B.I.O.T., Dominican Republic, Egypt: Red Sea, Equatorial Guinea: Bioko (?), Grenada (?), Guatemala (?), India: Andaman and Nicobar Islands, Jamaica (?), Malaysia: Sabah, Maldives, Oman, Saudi Arabia: Red Sea, Sudan, Turks and Caicos. The following borderline populations should also be noted: Brazil (?), Malaysia: West, Martinique, Venezuela (?).

Class 3/4: Iran, Mexico: Gulf and Caribbean, Solomon Is., Yemen (PDR).

Class 4 (500-1000): Papua New Guinea (?), Queensland, Western Australia.

Class 5 (more than 1000): Indonesia, Seychelles.

Nevertheless, there is little justification for the view that the C. mydas complex as a whole is facing imminent extinction, although some components surely are.

The conservation status of the Hawksbill

The overall status of the Hawksbill is difficult to assess. The species tends to nest singly or in small numbers at many scattered nest beaches, and, compared with C. mydas, is not so readily encountered in good numbers on feeding grounds. There are few contemporary and very few historical data that allow a quantified assessment of population trends.

The Hawksbill is typically rather rare in comparison with other circumglobal sea turtles, and it is not clear to what extent this is an inherent property of the species, or an artefact of prolonged exploitation pressure. There is no historical evidence that the species has in the past existed anywhere in numbers comparable to those attained by C. mydas, for example. It is notable that in Table 11 the numerical values of the categories used to rank populations by annual nesting numbers are an order of magnitude less in the case of E. imbricata than in C. mydas, but the general dispersion of populations on each scale is similar. Around the world, E. imbricata and C. mydas tend to use the same or neighbouring nest beaches, and often feed in the same tropical shallows and reef areas. There are very few sites where E. imbricata is more abundant; typically the ratio of Hawksbill to Green ranges between 1:5 and 1:10. Elementary ecological theory would predict that the Hawksbill will generally be less abundant than the Green Turtle, the former being mainly a carnivore in the somewhat patchy coral reef environment, and the latter a herbivorous grazing animal, often in highly productive sea grass pastures, but this is most unlikely to provide a complete explanation for present conditions.

Many believe that the present relative rarity of the Hawksbill is largely or entirely an artefact of prolonged exploitation for tortoiseshell and for eggs; this is a reasonable inference on the basis of current knowledge of the biology and exploitation of sea turtles. On this basis, Bjorndal (in litt. 20 June 1987) concludes that the species was much more common in the past than today, and Mortimer (in litt. 31 December 1987) believes the species to be far more rare now than centuries ago. Mortimer points out that although it appears to be relatively common in the Seychelles, for example, even after decades of heavy exploitation, this is illusory; in parts of the group, juvenile hawksbills have become rare, suggesting a sustained decline in recruitment. Such statements reflect a widely-held concern for the status of the Hawksbill, but the conviction that the species is at present globally much more rare than in past centuries is an hypothesis that cannot be tested owing to the lack of even rudimentary historical information on nesting numbers at other than a handful of sites.

Even if long term historical global decline of E. imbricata is strongly suspected rather than demonstrated, present populations are widely and acutely threatened by exploitation for shell and eggs, and by other factors, including beach development and incidental catch. The fact that the Hawksbill has been hunted for tortoiseshell for many centuries, although not necessarily without depletion, suggests that the species can sustain at least some exploitation; it seems certain, however, that the harvest of enormous numbers of animals in response to demand for shell in recent decades cannot be sustainable in the long term. If Hawksbills are similar to Green Turtles in requiring between two and five decades to reach

maturity, recruitment to the breeding population may already be too low at many sites, as a result of over-exploitation of adults and eggs. Recruitment at many nesting sites is suspected to be near to zero, and it is self-evident that near-zero recruitment is too low to maintain other than vestigial population levels. There is, however, no direct evidence on recruitment rates, and failure in recruitment tends to be inferred indirectly from the occurrence of heavy egg collection, or from anecdotal reports of fewer immature or sub-adult turtles at a given locality.

Whilst present rarity and dispersed nesting make protection and monitoring excessively difficult in most circumstances, the same factors would in theory render the species less susceptible to hunting pressure, or other adverse factors, than C. mydas (which may gather conspicuously off the nesting beach in mating aggregations and may nest in large numbers on restricted lengths of beach). However, other factors, such as a rise in the price of shell, the existence of mixed fisheries, and the spread of more advanced technology, can lead to hunting pressure on the species being maintained when it would otherwise be relaxed. In the Caribbean, for example, spiny lobsters and snappers inhabit the same reef habitats as Hawksbills, and while these other resources provide the mainstay of local fisheries, any Hawksbill encountered incidentally will also be taken, providing a significant supplement to the fishermen's income (Carr and Meylan, 1980).

In summary, whilst it is possible that the Hawksbill tends to be naturally more rare than C. mydas, and nesting numbers are very difficult to monitor owing to its nesting behaviour, there is firm quantitative or otherwise persuasive evidence for a severe decline in numbers at a small number of sites, many of these in the Western Atlantic-Caribbean region, and decline is strongly suspected at around half the total known breeding sites (including most remaining sites in the Western Atlantic-Caribbean). For many of the known and suspected breeding sites, trends are unknown, and even the distribution and occurrence of nesting is not comprehensively known. It is questionable whether the species as a whole is in imminent danger of extinction, but many populations are certainly acutely threatened, in particular by exploitation for eggs and the international tortoise-shell market.

Conservation status and IUCN Threatened Species categories

The growth in general awareness of the problem of depletion and possible extinction of species can be attributed in large degree to the development of the "Red Data Book" concept by IUCN in the 1960s (Scott et al, 1987). This involves an attempt to categorise species at risk according to the severity of the threats facing them, and the estimated imminence of their extinction. The present definitions of the IUCN categories are given below.

> Endangered (E). Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction. Also included are taxa that may be extinct but have definitely been seen in the wild in the past 50 years.
>
> Vulnerable (V). Taxa believed likely to move into the "Endangered" category in the near future if the causal factors continue operating. Included are taxa of which most or all the populations are decreasing

because of over-exploitation, extensive destruction of habitat or other environmental disturbance; taxa with populations that have been seriously depleted and whose ultimate security is not yet assured; and taxa with populations that are still abundant but are under threat from severe adverse factors throughout their range.

Rare (R). Taxa with small world populations that are not at present "Endangered" or "Vulnerable", but are at risk. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range.

Indeterminate (I). Taxa known to be "Endangered", "Vulnerable" or "Rare" but where there is not enough information to say which of the three categories is appropriate.

Insufficiently Known (K). Taxa that are suspected but not definitely known to belong to any of the above categories, because of lack of information.

Threatened (T). A general term to denote species which are "Endangered", "Vulnerable", "Rare", "Indeterminate", or "Insufficiently Known" (it should not be confused with the different use of the same term by the U.S. Office of Endangered Species). The term has been used in the 1988 IUCN Red List of Threatened Animals to identify taxa comprised of two or more sub-taxa which have differing status categories.

All sea turtles except the north Australian *Chelonia depressa* were treated as threatened species in the most recent edition of the IUCN Red Data Book dealing with reptiles (Groombridge, 1982). It was recognised that application of the standard IUCN status categories to sea turtle populations presented several difficulties, involving interpretation of the category definitions, the biological peculiarities of sea turtles, and the need to promote effective species conservation. On the advice of the IUCN Species Survival Commission, the categories used in previous editions of the RDB (1975-1979) were retained for species treated in 1982, pending a planned discussion of the IUCN status categories and their validity when applied to sea turtles. Both *C. mydas* and *E. imbricata* were thus categorised as "Endangered". Criticism has since been levelled at certain of the category designations made in 1982, in particular at the "Endangered" label for *C. mydas* (Mrosovsky, 1983); support for retention of the existing designations has been expressed by the IUCN/SSC Marine Turtle Specialist Group (K. Bjorndal, *in litt.*, 20 June 1987). Pritchard (1987) gives a useful discussion of the issue.

In the authors' opinion it is difficult to find justification for the view that the *C. mydas* complex as a whole is "in immediate danger of extinction", nor, consequently, for its current categorisation as "Endangered" (*sensu* IUCN). The factual evidence that is available suggests that the conservation status of the *Chelonia mydas* complex corresponds most closely with the definition of the IUCN category "Vulnerable" (see definitions above). The phrases: "most or all the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance" and "taxa with populations that are still abundant but are under threat from severe adverse factors throughout their range", could almost have been written to describe the Green Turtle. However, because of the biological peculiarities of sea turtle populations, it is quite possible for females to continue emerging on their nesting beach even though

recruitment could have ceased many years ago, and the population is in effect already doomed to disappear. Many turtle biologists believe that present and past exploitation of sub-adult and adult turtles, egg harvest, incidental catch and habitat disturbance, have put many populations in just such a precarious position. This interpretation, together with the observed decline in many populations, and the disappearance of a few, clearly call for urgent conservation measures, even though large numbers of turtles are still evident in many parts of the world, and the quantitative data available may not in themselves justify application of the "Endangered" category.

The prevailing view is that the Hawksbill Eretmochelys imbricata is most accurately categorised as "Endangered" and, while a reasonable case can be argued that the species is faced globally with imminent extinction, as is stipulated by the current definition of the IUCN "Endangered" category, that case is based as much, or more, on inference than on hard evidence. The relative lack of information on populations of Hawksbill, and strict literal interpretation of the IUCN status category definitions, could alternatively suggest that "Indeterminate" would be an appropriate category. It is not the case, contrary to a common misconception, that this category necessarily implies some lesser degree of threat to the species than the "Endangered" category; included are species that may be "Endangered" although data are insufficient to establish with certainty that this category is most apposite, rather than "Vulnerable" (or even "Rare"). Such data are available for some nesting populations, notably in the Caribbean region, but not globally.

Implementation of the firmest and most extensive protection and management measures is required for both C. mydas and E. imbricata, as befits "Endangered" species, whether or not the use of that category, sensu IUCN, is strictly justified. There is currently a need to demonstrate the risk of immediate extinction to merit use of the IUCN category "Endangered", and this can only clearly be demonstrated for certain populations of each species. However, it can be argued that wherever data on numbers and trends do not strictly meet the criteria for use of the "Endangered" category, to demand such rigorous data in the case of sea turtles may be dangerous. Several factors suggest a more cautious approach would be prudent, notably, the observed lack of individual movement between turtle populations such that depleted populations appear not to be replenished by those more flourishing, and the long-delayed attainment of maturity with consequent long-delayed population response to adverse or beneficial influences. If species conservation is the goal, it must be preferable, in cases of doubt, to err on the side of caution rather than wait until every possible item of evidence is assembled.

These considerations suggest that, in order to treat sea turtles (and other species with similar biological features) in a rational, fair and effective manner, either the system of categorisation or the unit being categorised, should be modified. Either new IUCN status categories or new definitions are necessary, or means should be found adequately to represent the relatively discrete nature of sea turtle nesting populations, presumably by defining and categorising each separately. The data are now available, at least for the C. mydas complex, to allow a useful attempt at separate categorisation of individual or regional population groups.

INTRODUCTION

Conservation status and CITES

All sea turtles have been listed on the Appendices of CITES since the Convention came into force in 1975. Initially, only Kemp's Ridley Lepidochelys kempii and the Atlantic populations of Hawksbill (E. i. imbricata) were listed on Appendix I, the remaining sea turtles appeared on Appendix II. At subsequent meetings of the Conference of the Parties to CITES, all taxa formerly listed on Appendix II have been moved to Appendix I, in recognition of the threats presented by international trade; actual and potential, direct and indirect. According to Article II of the Convention:

> "Appendix I shall include all species threatened with extinction which are or may be threatened by trade. Trade in specimens of these species must be subject to particularly strict regulation in order not to endanger further their survival and must only be authorized in exceptional circumstances."

These requirements were further refined by the "Berne Criteria" (CITES Resolution Conf. 1.1), adopted in 1976, which provide guidance on the type of biological information needed to demonstrate whether the species is threatened with extinction and on the possible levels of trade. They state that:

> "particular attention should be given to any species for which such trade might, over a period of time, involve numbers of specimens constituting a significant portion of the total population size necessary for the continued survival of the species".

It is indisputable that the C. mydas complex and E. imbricata are, in significant degree, threatened with extinction; it is similarly indisputable that, as reviewed above, international trade has been a primary cause of population decline, and remains an actual or potential threat to these species. The present Appendix I listing by CITES of the C. mydas complex (which is here understood to include East Pacific populations often referred to as C. agassizii) and E. imbricata is thus entirely appropriate, and we find no evidence suggesting otherwise. Indeed, it is probable that control on international commerce provided for by the terms of CITES has averted further decline in many populations. The information reviewed in the numerous country accounts in the present report confirms unambiguously that the existing legislation, including that intended to implement the provisions of CITES, must be maintained, and in many instances requires more rigorous enforcement.

The more particular question concerning the shift of individual local populations from Appendix I to II for the purposes of ranching, as provided for by a 1981 Resolution of the Conference (document Conf. 3.15), must be discussed on the basis of individual proposals. An IUCN-CITES Workshop was convened recently with the aim of providing guidelines to aid in the assessment of any future ranching proposals presented for consideration.

SUMMARY TABLE

Table 11. Chelonia mydas and Eretmochelys imbricata nesting populations: summary of distribution, size and exploitation. For Key to symbols, see below.

	Chelonia mydas					Eretmochelys imbricata				
	Population		Exploitation			Population		Exploitation		
	Nest	Nos	Adult	Nos	Egg	Nest	Nos	Adult	Nos	Egg
AMERICAN SAMOA	1-	_	M	50	?	?	_	?	_	?
ANGOLA	(1)	_	?	_	?	0	_	_	_	_
ANGUILLA	0/1	_	?	_	_	?	_	L	_	_
ANTIGUA/BARBUDA	1	39+	M/H	200	_	2	76 +	H	250	_
ARUBA	0	_	M	200	_	0/1	_	?	_	_
ASCENSION	3	1.6-3k	0	_	0	0	_	_	_	_
AUSTRALIA:										
QUEENSLAND	5+	30-50k	H	5-8k	L	(4+)?	_	L	_	H
W. AUSTRALIA	4+	5-10k?	L	100?	?	(4) ?	1k?	?	_	?
N. TERRITORY	(1)	_	M/H	2k	?	?	_	_	_	_
ISLAND TERR.	(1)	_	_	_	_	?	_	_	_	_
BAHAMAS	?	_	M/H	_	?	?	_	H	_	?
BAHRAIN	0	_	0?	_	_	0	_	_	_	_
BANGLADESH	1	_	L?	_	H	?	_	_	_	_
BARBADOS	0	_	L	_	?	0/1	_	L	_	?
BELIZE	1-	20	M	350	M	2-	_	H	360	M
BENIN	?	_	_	_	_	0	_	_	_	_
BERMUDA	0	_	_	_	_	0	_	_	_	_
BRAZIL	(2+)	_	H	5k+	?	(2)	_	M/H	1k+	?
B.I.O.T.	(2)	300	0	_	0	(3)	300	0	_	0
B. VIRGIN IS.	1	50-100	H	700	?	2	25-75	M/H	400	H
BURMA	(2)	<1k	L	100?	vH	(2)	_	?	_	vH
CAMEROON	?	_	_	_	_	?	_	_	_	_
CANARY ISLANDS	0	_	_	_	_	0	_	_	_	_
CAPE VERDE IS	(1)?	_	_	_	_	?	_	M	_	M/H
CAYMAN ISLANDS	0	_	_	_	_	0	_	M/H	_	_
CHILE	?	_	L	_	0?	0	_	_	_	_
CHINA (P. REP.)	1/2?	_	H	1k+	?	0 ?	_	?	_	I ?
COLOMBIA:										
CARIBBEAN	1	_	H	2.5-3k	M	(2) ?	_	M/H	.3-1k	?
PACIFIC	?	_	?	_	_	?	_	_	_	_
COMORO ISLANDS	3	1.8k	M	200?	0?	1/2	<50	?	_	?
CONGO	?	_	_	_	_	0	_	_	_	_
COOK ISLANDS	?	_	?	_	M	?	_	?	_	?
COSTA RICA:										
CARIBBEAN	4/5	5-50 k	M/H	_	M	(1/2)	_	?	_	L
PACIFIC	?	_	L	_	H	?	_	_	_	_
CUBA	?	_	H	3k+	L	?	_	H	3k+	L
CYPRUS	1-	50	0	_	0	0	_	_	_	_
DJIBOUTI	?	_	?	_	?	?	_	?	_	?
DOMINICA	0/1	_	?	_	?	(1)	_	?	_	_
DOMINICAN REP.	1/2	225	MH	500+	_	3 +	310	?	_	_

Table 11, continued.

	Chelonia mydas					*Eretmochelys imbricata*				
	Population		Exploitation			Population		Exploitation		
	Nest	Nos	Adult	Nos	Egg	Nest	Nos	Adult	Nos	Egg
ECUADOR:										
MAINLAND	1-	_	L	_	vL	(1)	_	L	_	L
GALAPAGOS	3	1-3.5k	vL	_	0?	0	_	0	_	0
EGYPT:										
MEDITERRANEAN	?	_	?	_	_	0	_	_	_	_
RED SEA	1	100	ML	300?	?	3	200-500	?	_	L
EL SALVADOR	?	_	L	_	H	?	_	ML	_	H
EQUAT. GUINEA:										
BIOKO	(2/3)	_	H	2-2.5k	vH	(3)	_	H	_	vH
MAINLAND	?	_	_	_	_	?	_	_	_	_
ETHIOPIA	(1)	_	M/H	_	_	?	_	?	_	_
FED. STATES MICRONESIA	(1)	_	L	_	?	(1/2)	_	L	_	?
FIJI	(1)	_	M	300+	M?	?	_	M	_	?
FRENCH GUIANA	1	100	L	50?	L	0/1	_	L	_	_
FR POLYNESIA	2	400-800	L	_	L	?	_	L	_	_
GABON	?	_	?	_	_	?	_	?	_	_
GAMBIA	?	_	_	_	_	0	_	?	_	_
GHANA	?	_	?	_	?	?	_	_	_	_
GRENADA	1	150-250	H	150	H	(3) ?	_	H	200+	H
GUADELOUPE	?	_	?	_	_	?	_	?	_	_
GUAM	1-	_	0	_	0	0/1	_	_	_	_
GUATEMALA:										
CARIBBEAN	?	_	?	_	H	(3)	_	?	_	?
PACIFIC	?	_	vL	_	H	0 ?	_	_	_	_
GUINEA	?	_	_	_	_	?	_	?	_	_
GUINEA-BISSAU	?	_	_	_	_	?	_	_	_	_
GUYANA	(1)	_	H	_	vH	(1)	_	H	_	vH
HAITI	?	_	?	_	_	?	_	H	_	_
HAWAII	1	180	vL	_	0	(1+)	_	0	_	0
HONDURAS:										
CARIBBEAN	?	_	H	_	H	?	_	MH	_	_
PACIFIC	?	_	_	_	_	?	_	_	_	_
HONG KONG	0	_	_	_	_	0	_	_	_	_
INDIA:										
MAINLAND	3	_	M	3k+	M/H	0/1	_	?	_	L
LAKSHADWEEP	1-	_	H	_	H	?	_	H	_	H
ANDAMANS & NICOBARS	1-	_	M	_	H	3	150-250	M	_	H
INDONESIA	5+	25-35k	vH	25k+	vH	5++	7-9k?	vH	_	vH
IRAN	1/2	150-500	vL	_	M	3/4	300-1 K	L	_	M
ISRAEL	0 ?	_	L	_	L	0	_	_	_	_
IVORY COAST	?	_	?	_	_	?	_	?	_	_
JAMAICA	1	100	H	_	H	(3)?	300 ?	H	_	H
JAPAN	1+	200+	_	_	_	?	_	_	_	_
KAMPUCHEA	?	_	?	_	?	? +	_	?	_	?
KENYA	1	100-200	M/H	_	H	2	50	H	_	?
KIRIBATI	1/2	200+	?	_	?	?	_	?	_	?

Table 11, continued.

	Chelonia mydas					*Eretmochelys imbricata*				
	Population		Exploitation			Population		Exploitation		
	Nest	Nos	Adult	Nos	Egg	Nest	Nos	Adult	Nos	Egg
KUWAIT	1-	40-	0?	_	0?	?	_	0	_	0
LIBERIA	?	_	M	_	_	0	_	_	_	_
MADAGASCAR	(1/2)	_	H	7k?	M	? ++	_	H	3k	M
MADEIRA/AZORES	?	_	_	_	_	0	_	_	_	_
MALAYSIA:										
SABAH	2+	800-1k	vL	_	vH	2/3	>100	L	_	H
SARAWAK	2+	750	vL	_	vH	(1) ?	_	L	_	H
W. MALAYSIA	2/3	1-1.4k	vL	_	vH	2/3	_	L	_	vH
MALDIVES	2/3	.8-1.3k	MH	1.5k	M	3	100-500	H	5k	M
MARSHALL IS.	(1)	_	?	_	?	?	_	?	_	?
MARTINIQUE	1-	20	M/H	_	?	2/3	75-125	?	_	?
MAURITANIA	(1)	_	M/H	_	_	?	_	_	_	_
MAURITIUS:										
MAURITIUS	0	_	_	_	_	0	_	_	_	_
ST BRANDON	1/2	300	M/H	300+	?	0	_	L	_	_
MAYOTTE	2-	250-500	H	_	_	0/1	_	_	_	_
MEXICO:										
PACIFIC	2/3	1-5k	vH	_	H	?	_	L	_	_
GULF/CARIB.	2	500	H	400?	H	3/4	500	M	_	?
MONTSERRAT	0/1	_	_	_	_	0/1	_	?	_	_
MOZAMBIQUE	1	200	H	_	M/H	? +	_	M/H	_	M/H
NAMIBIA	0	_	_	_	_	0	_	_	_	_
NAURU	0 ?	_	_	_	_	0 ?	_	_	_	_
NETH. ANTILLES										
LEEWARD	0/1	_	L	_	_	0/1	_	L	_	_
WINDWARD	0/1	_	L	_	L	0/1	_	_	_	_
NEW CALEDONIA	3/4	_	_	_	_	?	_	_	_	_
NEW ZEALAND	0	_	_	_	_	0	_	_	_	_
NICARAGUA:										
CARIBBEAN	0 ?	_	M	720?	H	(1/2)	_	H?	_	vH
PACIFIC	?	_	L	_	H	?	_	L	_	?
NIGERIA	?	_	_	_	_	0	_	_	_	_
NIUE	?	_	_	_	_	?	_	_	_	_
N. MARIANAS	0/1	_	M?	_	_	0	_	?	_	L
OMAN	4	>6k	M	1k?	M	3+	400	vL	_	M/L
PAKISTAN	3+	2-4k	L	_	L	0	_	_	_	_
PALAU REPUBLIC	(1/2)	_	LM	_	M/H	?	_	L	_	H
PANAMA:										
CARIBBEAN	?	_	HM	_	L	(1/2)	_	H	_	?
PACIFIC	(1)	_	L	_	L	?	_	_	_	_
P. NEW GUINEA	(2/3)	1-2k?	M	5k+	M	(4)?	_	L	_	M
PERU	(1-)	_	M	2-3k	?	0	_	_	_	_
PHILIPPINES	3	2.5-3k?	H	_	M	(1/2)	_	H	_	M
PITCAIRN IS.	0	_	_	_	_	0	_	_	_	_
PUERTO RICO	0/1	4	MH	_	MH	1/2	20-50	MH	_	MH
QATAR	?	_	ML	_	M	(1)	_	?	_	?

Table 11, continued.

	Chelonia mydas					*Eretmochelys imbricata*				
	Population		Exploitation			Population		Exploitation		
	Nest	Nos	Adult	Nos	Egg	Nest	Nos	Adult	Nos	Egg
REUNION:										
REUNION	0	_	_	_	_	0	_	_	_	_
EUROPA	3-4	2-11k	0	_	*	0	_	_	_	_
TROMELIN	2/3	.7-1.3k	0	_	*	0	_	_	_	_
GLORIEUSES	1	100-200	_	_	1	1?	_	_	_	
JUAN/NOVA	0/1									
SAO TOME & PRINCIPE	? +	_	M/H	_	M/H	? +	_	H	_	M/H
SAUDI ARABIA:										
GULF	2/3?	1-2k?	L	_	L	2	100	L	_	L
RED SEA	1/2	_	L	_	LM	3	200-400	L	_	L
SENEGAL	(1)	_	H	_	?	?	_	H	_	?
SEYCHELLES	3	3-4.7k	M	500+	L	5	1-1.8 K	H	500+	L
SIERRA LEONE	?	_	_	_	_	?	_	_	_	_
SINGAPORE	0	_	_	_	_	0	_	_	_	_
SOLOMON ISLANDS	1+	_	?	_	H	3/4	500?	?	_	H
SOMALIA	3/4?	_	H	4k?	?	?	_	?	_	?
SOUTH AFRICA	0	_	_	_	_	0	_	_	_	_
SRI LANKA	(1)	_	H	3-5k	vH	?	_	?	_	vH
ST KITTS, NEVIS	?	_	L	20-40	L	?	_	L	_	L
ST LUCIA	0/1	_	?	_	?	(1)	_	?	_	L
ST VINCENT	0/1	_	?	_	_	(1/2)	_	L	_	L
SUDAN	?	_	_	_	_	3 +	300-350	_	_	_
SURINAME	3	1.5-2k	0	_	M	1	_	0	_	L
TAIWAN	?	_	_	_	_	?	_	_	_	_
TANZANIA	1/2	200-300	M/H	500?	0?	2-	50	?	_	?
THAILAND	2	_	?	_	vH	(1/2)	_	_	?	vH
TOGO	?	_	_	_	_	0	_	_	_	_
TOKELAU ISLANDS	1	120	?	_	?	?	_	?	_	?
TONGA	?	_	?	_	?	?	_	?	_	?
TRINIDAD/TOBAGO	0/1	_	H	500?	?	?	_	H	_	?
TURKEY	(2)	_	L	_	?	0	_	_	_	_
TURKS/CAICOS	1	45-105	L	_	_	3	125-275	_	_	_
TUVALU	?	_	_	_	_	0 ?	_	_	_	_
UAE	?	_	L	_	M/H	?	_	?	_	?
UNITED STATES	1	180	0	_	0	0/1	2	_	_	_
US PACIFIC IS	?	_	_	_	_	?	_	_	_	_
US VIRGIN IS.	?	_	?	_	_	1/2	25	?	_	_
VANUATU	(1/2)	_	M/H	30-60	M/H	?	_	_	_	
VENEZUELA:										
AVES I.	1/2	200-500	0?	_	0?	1/2?	_	_	_	_
MAINLAND+IS.	1	_	M/H	_	M/H	2/3?	_	L	_	L
VIET NAM	? +	_	?	_	_	? +	_	?	_	?
WALLIS & FUTUNA	?	_	_	_	_	?	_	_	_	_
WESTERN SAHARA	?	_	_	_	_	?	_	_	_	_
WESTERN SAMOA	0/1	_	M	_	_	1/2	<45	H	_	H
YEMEN (ARAB R.)	?	_	L	_	M	?	_	L	_	?
YEMEN (PDR)	4/5	10k	L?	_	L	3/4	500	L	_	L
ZAIRE	?	_	_	_	_	0	_	_	_	_

<u>Key</u>

Column 1. <u>Size class of nesting population</u> (Green Turtle).

0 = no nesting known and significant nesting unlikely; 1 = up to 250 females nesting annually, 2 = 250-1000, 3 = 1000-5000, 4 = 5000-10 000, 5 = more than 10 000. Ex = local population extirpated or virtually so.

? = nesting certain or possible, but no further data and impossible to place in size class; most such cases are suspected to involve low or very low nesting numbers; ? + = as last, but suspected to be an important site.

Numbers separated by oblique = population size intermediate; 0/1 = nesting virtually insignificant. Numbers 1-4 with "-" appended = near low limit of size class; with "+" = near upper limit. Number not in parentheses = relatively firm estimate; number in parentheses = inferred from few data; with ? appended = marked uncertainty.

Columns 2 & 7 <u>Numerical estimate of annual nesting numbers</u>.

Only estimates given in primary sources or others considered reliable are given. "k" = 1000's. Appended "-" indicates number is upper limit, "+" indicates lower limit. See country accounts for further information.

Columns 3 & 8 <u>Level of exploitation of adults</u>
L = Low, M = Moderate, H = High, ? = believed to occur, level uncertain, 0 = none.

Columns 4 & 9 <u>Quantitative assessment of adult harvest</u>
k = 1000s

Columns 5 & 10 <u>Level of egg harvest</u>
L = Low, M = Moderate, H = High, ? = believed to occur, level uncertain
vH = 90-100% harvest, * = hatchlings removed for ranch, 0 = none.

Column 6. <u>Size class of nesting population</u> (Hawksbill).

0 = no nesting known and significant nesting unlikely; 1 = up to 25 females nesting per year, 2 = 25-100, 3 = 100-500, 4 = 500-1000, 5 = more than 1000. Note: the numerical limits of these size classes are an order of magnitude smaller that for <u>C. mydas</u> (Table 11). Other symbols as in column 1.

POPULATION: Chelonia mydas

Nesting sites Nesting has been recorded on Swains Island and on Rose Atoll (Anon., 1979b). Johannes (1986) said that the only significant Green Turtle nesting was Rose Atoll, with a few scattered nests in the Manu'a Group.

Nesting numbers No information is available for Swains Island. Hirth (1971) recorded finding 35 nest pits of various ages on Sand Islet and 301 on Rose Islet, the two nest sites at Rose Atoll, on 7 October 1970. Hirth was uncertain of the nesting species (no turtles nested during the night of his visit), but cited Sachet (1954), who in turn cited an earlier report that C. mydas was the most common nester. Eleven large C. mydas emerged on Rose Islet on 21 November 1974; one was seen to nest (Anon., 1979b). The Rose Atoll beaches are composed of coral fragments and this renders nesting difficult.

Trends in nesting numbers A 19th century report cited by Johannes (1986) suggested that "a great number of turtles" nested on Rose Atoll, and the population is now thought to be smaller.

Nesting season Hirth (1971) was informed that nesting occurs in August-September on Rose Atoll, but significant nesting is known to take place in November, and C. mydas is reported to nest on Swains Island in November-December (Anon., 1979b).

POPULATION: Eretmochelys imbricata

Nesting sites The species is said to nest at Rose Atoll (source in Hirth, 1971); it is captured in the Manu'a Islands during the breeding season, which suggests that nesting may occur, and some sparse nesting may occur at Tutuila (Anon., 1979b).

Nesting numbers At Tutuila and Manu'a the Hawksbill is the more common of the two turtle species recorded in American Samoa, but it is unknown whether nesting is correspondingly higher, or whether this species is mainly using the area as a foraging ground.

Trends in nesting numbers Fishermen in Tutuila believed that turtles had declined considerably in numbers in the five years prior to 1981, but it is uncertain if this refers to nesting or foraging turtles (Johannes, 1986).

Nesting season No specific information; the statement reported by Hirth (1971), that turtle nesting at Rose Atoll is between August-September, may apply to this species.

Foraging sites No specific information. The species appears to occur in waters around Tutuila and Manu'a; these may be foraging grounds.

THREATS

Rose Atoll reportedly swarms with rats (Hirth, 1971); Polynesian rats have been seen to attack hatchlings on the island (Anon., 1979b).

AMERICAN SAMOA

EXPLOITATION

Commodity Both eggs and meat of E. imbricata are consumed. C. mydas is also eaten, though its nesting is largely confined to Rose Atoll which is uninhabited and is now a Wildlife Refuge. The shell of E. imbricata is used locally for jewellery and decoration (Anon., 1979b).

Hunting intensity Turtle eggs are collected on Swains Island (Balazs, 1982c) and the 50 or so local inhabitants are thought to have a legitimate subsistence need for turtle products. The bulk of the human population resides on Tutuila and Olosega, and it is estimated that about 50 turtles a year are caught there, although there is said to be little interest in catching turtles (Johannes, 1986).

Hunting methods Johannes (1986) described the use of long nets to fish for turtles: once a turtle was spotted by a lookout on shore a net would be set to seaward of it. The turtle would then be frightened into the net by men beating the water with sticks. Turtles were traditionally considered sacred in Samoa and, when caught, they had to be given to the chief for distribution. Traditional customs are said to be being swamped by the intrusion of Western society (Johannes, 1986). Green Turtles are said to be caught on the nesting beaches at Swains Island (Anon., 1979b).

Historical trends It is not known whether the declining turtle numbers reported by fishermen on Tutuila (Johannes, 1986) reflect declining catches.

Domestic trade None known.

International trade American Samoa is covered by the American ratification of CITES (14 January 1974). CITES Annual Reports contain only two records of trade in turtle products from American Samoa, both imports to the USA in 1984, comprising one shell of C. mydas and eight carvings of Cheloniidae.

The only indication of trade in raw turtle shell with American Samoa contained in the Customs reports consulted was the import to Japan of 42 kg of other tortoiseshell (i.e. not E. imbricata) in 1978. Fijian Customs statistics record the export of some worked turtle shell to American Samoa in most years since 1970, and the values of these exports are given in Table 12.

Table 12. Values (in Fijian $) of exports of worked tortoiseshell to American Samoa recorded in Fijian Customs statistics

Year	1970	1971	1972	1973	1974	1975	1976	1977
F$	1472	264	818	407	24	75	1490	7758
Year	1978	1979	1980	1981	1982	1983	1984	1985
F$	6253			0	0	0	3254	468

LEGISLATION

US Federal legislation (i.e. the Endangered Species Act, q.v.) applies in American Samoa, and all sea turtles are protected. Enforcement is said to be poor (Johannes, 1986).

POPULATION: Chelonia mydas

Nesting sites The species appears to be common along the Angolan coast (Hughes et al., 1973), but rather little detailed information on nesting sites is available. Huntley (1972) encountered "very large" turtle populations, which included C. mydas, around Foz do Cunene in the Iona National Park, and suspected that the species nested on the Park's 160-km coastline. Huntley (1974) reported C. mydas nesting at unspecified points south of Luanda. Hughes et al. (1973) noted the possibility that large numbers nested south of Luanda. The only recent data available were gathered by Carr and Carr (1985), who surveyed about half of the total coastline in October 1983 (mostly by air), from Quicombo, near Sumbe (Novo Redondo), north to the northern border of the Cabinda enclave. They found evidence of suspected C. mydas nesting on the Cabinda coast and, in Angola proper, nesting between the mouth of the Congo River and Luanda, and near Barra do Cuanza, a little south of Luanda. Nesting is also recorded at Bahia dos Tigres (Monard, 1937, cited in Brongersma, 1982).

Nesting numbers Carr and Carr (1985) recorded a total of only 67 turtle nests (or nesting attempts) along the entire northern half of Angola's coast from Quicombo northward (including Cabinda); 32 of these were old Leatherback Dermochelys coriacea nests and the remaining 35 were assigned to C. mydas and Olive Ridley Lepidochelys olivacea. On this evidence, C. mydas nesting is very sparse indeed; however, the Carrs' visit was before the suspected main nesting season, and traces of nesting earlier in the season may have been erased. Huntley (1974) recorded 613 turtle nests on 150 km of coastline at an unspecified location south of Luanda; both C. mydas and Dermochelys were said to be nesting at the time, but the proportion of C. mydas nests is unknown. Huntley (pers. comm., cited in Hughes, 1982) also found evidence of extensive turtle nesting north of Luanda (i.e. within the area surveyed by Carr and Carr); again, the species composition is unknown. The southern half of the coast, from Quicombo south to the border with Namibia has yet to be surveyed adequately; C. mydas nesting here is suspected to be significant (Huntley, 1972). However, Hughes (1982) stated there are far more nesting turtles in northern Angola.

Trends in nesting numbers Very little information is available; a 1923 source (cited in Monard, 1937, in turn cited in Brongersma, 1982) stated that C. mydas formerly nested frequently at Bahia dos Tigres but had become rare by 1923. According to Carvalho (in litt., 1986), nesting C. mydas numbers are declining.

Nesting season Huntley (1974) reported significant levels of turtle nesting, including by C. mydas, in December 1972. Carr and Carr (1985) found very little evidence of C. mydas nesting in October 1983, but noted that the turtle nesting season was just beginning; their informants reported November-January was the peak nesting period.

Foraging sites Foraging C. mydas appear to occur along the entire Angolan coast, but little information on preferred feeding sites is available. Carr and Carr (1985) reported that most immature and sub-adult turtles seen during their aerial surveys were in or near one of the many small bays along the coast. These authors cite Mussulo Bay, immediately south of Luanda, as one of the largest in the country, and rich in corals, sea grasses and algae. Nineteen of 23 turtles seen in the Bay were C. mydas; 11 of these were adults and eight immature or sub-adult.

ANGOLA

POPULATION: Eretmochelys imbricata

At present no information is available on the occurrence of E. imbricata, either nesting or foraging, in Angola. Carr and Carr (1985) obtained no remains, verbal reports, or any other evidence of the species during their surveys in northern Angola (including Cabinda).

EXPLOITATION

Commodity There is extensive use of the meat, eggs and carapaces of turtles along the Angolan coastline, and all species present are said to be taken in the nesting season (Carr and Carr, 1985).

Hunting intensity There is no information on the levels of exploitation.

Hunting methods Apart from capture of turtles on beaches, there is very little evidence of dedicated turtle hunting in Angola, and most are said to be caught incidentally in fish nets (Carr and Carr, 1985).

Historical trends There is some indication that the sale of shells to local artisans has declined as a result of stricter enforcement of the protection legislation (Carr and Carr, 1985). However, as turtles are not thought to be deliberately hunted, this does not necessarily indicate a decreased catch.

Domestic trade The shells of C. mydas and L. olivacea are said to be sold to local artisans for the manufacture of curios. Raids on shops were carried out by the wardens of the Direcção Nacional de Conservação da Natureza in 1982, and contraband turtle shell products were confiscated. This is said to have reduced the readiness of traders to purchase turtle shells. Some "tortoiseshell" (E. imbricata) goods were seen on sale in Luanda, but Carr and Carr (1985) reported that they all originated in São Tomé (Gulf of Guinea).

International trade The Customs reports consulted contain no indication of any international trade in tortoiseshell with Angola, but it is claimed that some tortoiseshell products are imported from São Tomé (Carr and Carr, 1985).

Angola is not a Party to CITES, but CITES Annual Reports contain two references to trade in turtle products from Angola. In 1985, Italy reported exporting 54 carvings of C. mydas, said to have originated in Angola, to Japan; and in 1984, Norway reported importing one scale of Chelonia sp. from Angola.

LEGISLATION

Hunting Regulations 11 December 1957. Amended Diploma Legislativo 107/72, 13 November 1972; Decreto 14/84, 27 February 1984.

All Testudines, including turtles, are totally protected, under the 1972 Amendment.

POPULATION: Chelonia mydas

Nesting Sites Richardson and Gumbs (1984) reported nesting on Dog Island and at Prickly Pear Cays. Other available information is limited to a report of one nest at Pigfish Bay, Dog Island, some ten years ago (Meylan, 1983).

Nesting numbers The species rarely nests on Anguilla; some solitary nesting occurs (Richardson, 1984; Meylan, 1983).

Trends in nesting numbers No specific information. Meylan (1983) reported sea turtle populations to be depleted but it is uncertain if this applied to nesting populations.

Foraging sites Together with Hawksbills, Green Turtles were the most common species in Anguillan waters; juveniles, sub-adults and adults were present year round (Meylan, 1983). Richardson and Gumbs (1984) reported foraging at Shoal Bay, North Hill Village, Lower South Hill, Long Bay, Mead's Bay, Scrub Island, Sandy Island, Sombrero Island, Dog Island, and between South Shoal Bay and Blowing Rock. Green Turtles were also frequently sighted at Prickly Pear Cays and off Isaac's Cliff; juveniles reportedly foraged in groups around the bays on the main island (Meylan, 1983).

Migration A Green Turtle that had been tagged at Cape Canaveral, Florida was caught at sea at Sandy Island five years later (R. Witham, in litt. to Meylan, 1983). Local opinion was that Anguillan Green Turtles migrated to Aves Island to nest (Meylan, 1983).

POPULATION: Eretmochelys imbricata

Nesting sites The Hawksbill was the principal species nesting on Anguilla, according to Meylan (1983), who reported frequently used nesting sites on Dog Island (Savannah Bay, Stoney Bay, Pigfish Bay and Great Bay) and also nesting on the main island and on Prickly Pear Cays. Richardson and Gumbs (1984) also reported nesting on Dog island, Prickly Pear Cays, and on some beaches on the main island.

Nesting numbers Meylan (1983) considered the number of Hawksbills nesting annually on Anguilla and the associated cays to be relatively low.

Trends in nesting numbers No specific information. Meylan (1983) considered sea turtle populations to be depleted.

Foraging sites Hawksbills of all sizes were present year round and good foraging habitat occurred in the extensive reef to the north of the island and around the offshore cays (Meylan, 1983). Richardson and Gumbs (1984) reported foraging at Shoal Bay, North Hill Village, Lower South Hill, Mead's Bay, Scrub Island, Sandy Island, Dog Island, Sombrero Island and at the barrier reef off the north coast of the main island. Hawksbills were also frequently sighted at Prickly Pear Cays and off Isaac's Cliff (Meylan, 1983).

THREATS

ECNAMP (1980, cited in Meylan, 1983) reported that several nesting beaches on Anguilla (Shoal Bay, Mead's Bay and Barnes Bay) had been or were in the

process of being mined for sand for construction purposes.

EXPLOITATION

Commodity The carapaces and meat of Hawksbills and Green Turtles were sold locally or on St Martin, and the eggs of all species were taken whenever they were found (Meylan, 1983). Meylan (1983) reported there was no local handcraft in tortoiseshell.

Hunting intensity In 1980, only about ten people were engaged in setting nets for turtles (Meylan, 1983). According to Richardson and Gumbs (1984), between five and ten people annually were involved in turtle fishing, though none were exclusively dependent on this activity. Some divers who had become aware of the value of tortoiseshell now concentrated on fishing for Hawksbills (Meylan, 1983).

Hunting methods The traditional method of setting tangle nets was apparently dying out due to the increasing cost of net materials and gasoline, and because fishermen were turning to the more lucrative lobster business. Sea turtles were now predominantly taken by young divers who combed the reefs in search of lobster, fish and conch. Although they took turtles opportunistically, the use of spearguns enabled these divers to catch nearly every turtle they encountered (Meylan, 1983). Meylan (1983) considered the Hawksbill to be by far the most vulnerable species because it shared the habitat of the lobster. Richardson and Gumbs (1984) reported landing sites for turtles at Sandy Ground, Island Harbour, Crocus Bay and Rendezvous Bay. The turtles landed here were caught by both turtle nets and spear guns.

Historical trends As tourism in the region increased, exploitation pressures escalated and, with the growth in the use of spearguns, more turtles were being killed than ever before (Meylan, 1983).

Domestic trade Meylan (1983) described the domestic trade in turtles and turtle products on Anguilla. Green Turtle and Hawksbill meat was sold locally to individuals and to hotels, the price in 1980 being approximately US$2 a kg. The dried and prepared carapaces of Green Turtles and Hawksbills were also sold locally, though the volume of trade was considered to be small. Meylan saw the shells of 15 juvenile Hawksbills and one sub-adult Green Turtle for sale at various places on Anguilla. All of the Hawksbill shells were below the 9 kg minimum size limit and had, therefore, been captured illegally. There appeared to be no trade in turtle eggs, presumably because of their scarcity. Richardson and Gumbs (1984) reported the sale of polished carapaces of juvenile Hawksbills at a gift shop in Sandy Ground, at the airport and at a restaurant/bar in Island Harbour.

International trade Aspects of international trade were also described by Meylan (1983). Some fishermen sold turtle meat on St Martin, where there was a steady demand to supply the hotel restaurants. Tortoiseshell was sold to buyers on St Martin or to entrepreneurs from St Thomas and Puerto Rico, who periodically visited Anguilla for this purpose. The price for raw shell in 1980 was US$2 a kg.

Anguilla is a British dependency but is not covered by the UK's ratification of CITES. CITES annual reports for the period 1977-1985 did not record any trade in sea turtles or their products to or from Anguilla.

LEGISLATION

Turtle Ordinance Cap. 99, 1 January 1948 establishes a close season from 1 June to 30 September inclusive. It is therefore prohibited to take, kill, sell, buy, possess etc. turtles or their eggs or meat between 1 June and 30 September. The taking etc. of turtles under 20 lb (9 kg) is prohibited at all times. [It is not certain whether this ordinance is still in force since the independence from St Kitts-Nevis.]

ANTIGUA AND BARBUDA

POPULATION: Chelonia mydas

Nesting sites Joseph et al. (1984) reported nesting at Pinchin Bay, Pasture Bay and Grape Bay on Antigua, and on Barbuda at Coco Point Beach, Continuous Beach, North Beach, Rabbit Island Beach, Welch Point Beach, Rubbish Bay, Castle Bay, Pelican Bay, Spanish Point, and Hog Point to Two Feet Bay. Meylan (1983) also reported nesting at Long Bay on Antigua and from Billy Point to the River on the west coast of Barbuda.

Nesting numbers Joseph et al. (1984) estimated the number of nesting females on Antigua and Barbuda in 1982 to be 39. Massington (in litt., 30 September 1986) considered nesting Green Turtles to be of low abundance and Meylan (1983) reported the nesting density of Green Turtles and Hawksbills on Barbuda to be probably higher than on any other Leeward Island but considered absolute numbers to be "very modest".

Trends in nesting numbers Massington (in litt., 30 September 1986) considered the Green Turtle nesting population to be in decline. Cato et al. (1978, cited in Meylan, 1983) noted a decline in the number of sea turtles nesting on Antigua.

Nesting season Joseph et al. (1984) reported nesting in June and July on Antigua and from May to November on Barbuda.

Foraging sites Joseph et al. (1984) considered the whole of the continental shelf around Antigua and Barbuda to be suitable foraging habitat all year round. Green Turtles were the most common species in the waters around Antigua and Barbuda according to Meylan (1983), who reported probable foraging at Welch Point and at the entrance to Codrington Lagoon on Barbuda, and particularly good foraging habitat in the bays of the northern coast of Antigua. Meylan (1983) also reported foraging on the western and southern coasts of Antigua at Hawksbill Bay, Pinching Bay, Dark Wood, Urlings, and Mount Carmel.

POPULATION: Eretmochelys imbricata

Nesting sites Joseph et al. (1984) reported nesting on Antigua at Carlise Bay, Morris Bay, Crabb Hill Bay, Darkwood Beach, Fryes Bay, Valley Church Bay, Pearns, Pinchin Bay, Runaway Bay, Pasture Bay, Grape Bay, Long Bay, Hog Hole, Green Island, Mill Reef, Indian Creek, Windward Bay, Pléppe Bay, Turtle Bay, Rendezvous Bay, and Tucks Bay; and nesting on Barbuda at Coco Point, Spanish Well Point, Continuous Beach, North Beach, Rabbit Island Beach, Rubbish Bay, Castle Bay, Welch Point Bay, Pelican Bay, Spanish Point, and from Hog Point to Two Feet Bay. Nesting sites were reported, by Meylan (1983), along the shore from Billy Point to the River on Barbuda, and around Five Islands Village on Antigua at Galley Bay, Landing Bay, Hawksbill Bay, Pinchin Bay (reported to be the best), and Long Bay.

Nesting numbers Massington (in litt., 30 September 1986) considered nesting Hawksbills to be of low abundance. Joseph et al. (1984) estimated the number of nesting females on Antigua and Barbuda in 1982 to be 76. According to Meylan (1983), the nesting density of Green Turtles and Hawksbills on Barbuda was probably greater than elsewhere in the Leewards Islands, but absolute numbers were still "very modest".

Trends in nesting numbers Massington (in litt., 30 September 1986) considered the Hawksbill nesting population to be in decline. Cato et al.

(1978, cited in Meylan, 1983) noted a decline in the number of sea turtles, particularly Hawksbills, nesting on Antigua.

Nesting season Joseph et al. (1984) reported nesting June-October on Antigua and May-November on Barbuda.

Foraging sites According to Joseph et al. (1984), foraging occurred year round on the continental shelf around Antigua and Barbuda. Meylan (1983) considered Hawksbills to be common in foraging habitats all around Barbuda and reported their presence in feeding sites on the western and southern coasts of Antigua at Hawksbill Bay, Pinchin Bay, Dark Wood, Urlings and Mount Carmel.

EXPLOITATION

Commodity Income was derived from the sale of meat, carapace, raw shell, worked tortoiseshell, and live turtles; juvenile turtles being kept for local consumption (Meylan, 1983).

Hunting intensity Joseph et al. (1984) reported estimated landings in 1982 of 150 Green Turtles and 250 Hawksbills, and estimated the annual catch for subsistence use to be 20 turtles at sea, 30 turtles while nesting, and 2500 eggs.

Meylan (1983) discussed the intensity of hunting on Antigua. There were approximately 12 fishermen on Antigua who still set nets for turtles. In 1980, a turtle fisherman at Urlings reported catching an average of 24 turtles per year, most of which were Green Turtles. A fisherman at Willikies reported catching 50 turtles in 1978, and a total of 20 (16 Green Turtles, 4 Hawksbills) between October 1979 and late April 1980.

According to Cato et al. (1978, cited in Meylan, 1983), a resident who coordinated the export business on Barbuda estimated that "several hundred" turtles were exported annually. Meylan (1983) considered that heavy exploitation had continued and had possibly increased since then.

Hunting methods According to Meylan (1983) there were approximately 12 fishermen on Antigua still setting turtle nets; though turtles were being increasingly caught by spearfishermen and were also taken on nesting beaches whenever they were encountered. On Barbuda, Meylan (1983) reported the capture of turtles by both lobster divers and net fishermen, with a single fisherman capable of setting as many as 11 nets. Turtles were also chased with outboard-powered boats and captured by hand, and small turtles were taken incidentally in trammel nets. Turtles and their eggs were routinely taken at nesting beaches and surveillance for tracks were carried out by boat, incidental to other fishing activities.

Historical trends Meylan (1983) reported the practice of setting nets for turtles on Antigua apparently to have been more common in the past. Rebel (1974, cited in Meylan, 1983) gave the annual catch on Antigua for the period 1943-1948 as 67 turtles (range 40-116) and, in addition, noted a decline in the number of turtles caught in Antigua. Meylan (1983) also noted that residents of Five Islands Village used to hunt for turtles regularly on the beach but rarely did so now, presumably because so few turtles emerged.

ANTIGUA AND BARBUDA

According to Meylan (1983), the growth of the lobster fishery on Barbuda into a major industry had had significant repercussions, by increasing the number of people out on the reefs and by providing a mechanism to transport live turtles to market that would not have otherwise existed.

Domestic trade Meylan (1983) discussed domestic trade on Antigua. Some meat was sold in the villages on Antigua at US$0.80 a kg but a large proportion of the turtle meat available on the island was sold under contract to hotel restaurants by the fishermen. Tortoiseshell was worked locally and marketed in tourist shops in St John's and whole polished carapaces were sold to local souvenir shops. Shell buyers went directly to the homes of fishermen to buy raw shell; the price being paid in 1980 was US$12 a kg. The meat and shell of an adult Hawksbill that had been caught at Galley Bay in June 1979 earned the captor US$111.

According to Cato et al. (1978, cited in Meylan, 1983), turtle meat on Barbuda was sold to restaurants on the island and was also exported to Antigua and other islands. Turtle carapaces and tortoiseshell were also exported but there was no tourism on Barbuda to support a local souvenir trade.

International trade CITES annual reports for the period 1977-1985 record the export to the USA in 1981 of one C. mydas shell (via another country) and in 1982 of one C. mydas shell; and the export to Switzerland in 1985 of one Cheloniidae body. Antigua and Barbuda are not covered by the UK's ratification of CITES.

Japanese customs statistics show the import from Antigua and Barbuda of 49, 286, 221 and 293 kg of bekko in 1983, 1984, 1985 and 1986 respectively.

Cato et al. (1978, cited in Meylan, 1983) noted that during the winter season live Green Turtles were flown out several times each week on cargo planes that came to Barbuda to pick up lobsters. Several hundred turtles were apparently exported each year. Cato et al. (1978, cited in Meylan, 1983) also reported that turtle meat was sold to hotel restaurants on Guadeloupe and, to a lesser extent, on St Thomas and Puerto Rico. The Ministry of Agriculture, Fisheries and Lands (in litt., 29 December 1986) related reports that a French buyer had been enquiring about supplies of E. imbricata shell.

LEGISLATION

Turtle Ordinance 1927

Close season established for turtles and turtle eggs from 1 June to 30 September inclusive.
The taking or catching of turtles under 20 lb (9 kg) is prohibited.
The buying, selling or exposing for sale, or having in possession, of turtle eggs from 1 June to 30 September is prohibited.

POPULATION: Chelonia mydas

Nesting sites C. mydas is not thought to nest on Aruba (Van Buurt, 1984a).

Foraging sites Van Buurt (1984a) reported turtle grass beds off the south coast of Aruba, but had no evidence of any turtles foraging in the area.

POPULATION: Eretmochelys imbricata

Nesting sites Van Buurt (1984a) reported possible nesting at various bays on the north coast. There is no information on the numbers, the season or any foraging sites.

THREATS

Van Buurt (1984a) mentioned that tourist development along the southern and western beaches made it virtually impossible for turtles to nest there, although he had no evidence that they had ever done so.

EXPLOITATION

There is no information on the local exploitation of turtles on Aruba, but some turtle meat landed by Venezuelan fishermen is said to be sold on the island (J. Sybesma in litt., 30 March 1987).

International trade Aruba is not a Party to CITES. It became independent from the Netherlands Antilles in 1986. Any international trade before that date is discussed in the Netherlands Antilles (Leeward Islands) account.

LEGISLATION

Eilandsverordening 1980, Management of the marine environment.
All turtle nests and eggs are protected. Spearfishing is prohibited.

ASCENSION

POPULATION: Chelonia mydas

Nesting sites There are 32 cove beaches distributed along the west and north-west coasts of Ascension Island, ranging in length from 10 to 915 m. Much earlier information (Carr, 1975; Mortimer and Carr, 1984) is synthesised by Mortimer and Carr (1987).

Nesting numbers Relatively comprehensive population data are available, gathered by Mortimer during the 1976-77 and 1977-78 nesting seasons. Nest numbers were estimated by counting tracks during the nesting season, and correcting for the mean 1.7 trial emergences before nesting actually occurred, and with a further correction for imperfect tagging efficiency. Numbers of nesting turtles were calculated assuming either 3 or 4 clutches per female per season (respectively providing the upper and lower limits of each annual estimate). Information given by Mortimer and Carr (1987) is summarised in Table 13.

Table 13. Estimates of numbers of tracks, nests and nesting females at Ascension, during the 1976-77 and 1977-78 seasons (data from Mortimer and Carr, 1987).

	Tracks	Nests	Nesting Females
1976-77	18 192	7910-10 764	1980-3590
1977-78	12 093	5257-7154	1317-2386

A total of 5375 and 5599 tracks were counted in the 1980-81 and 1981-82 seasons respectively (R. Whitla in litt., 10 October 1986). Although these counts are much lower than Mortimer's, it is not clear how comparable the survey procedures were, and some small beaches were omitted.

The Ascension colony, with an average of around 1650-3000 females a season (Mortimer and Carr, 1987), is one of the three large populations extant in the Atlantic; it is much smaller than the Tortuguero (Costa Rica) population (which has between 5000 and 50 000 females a season), and perhaps a little larger than the Suriname population (which has around 1500-2000 a season).

Trends in nesting numbers Little information is available; numbers are probably stable (J. Mortimer in litt., 12 December 1981; R. Whitla in litt., 29 August 1986). The 1981-1982 track counts (see above) are much lower than those for 1977-1978; this difference may to some extent be due to a decline in nesting numbers, to between-year fluctuations in nesting numbers, or (perhaps most likely) to different survey procedures. Parsons (1962) reported evidence from 1926 that turtle nesting populations appeared to have declined as a result of the continuing exploitation over the past two centuries.

Nesting season The season is quite clearly-defined, and extends from December to May, coinciding with the wettest time of year and the period of heaviest wave action (the Ascension sand is coarse and dry and this timing may increase reproductive success). Nesting peaks in March-April (Mortimer and Carr, 1987).

Foraging sites Ascension is an oceanic island with no littoral platform supporting marine vegetation, the primary diet of C. mydas; the breeding season at Ascension thus appears to be a period of fasting (although turtles sometimes feed on refuse dumped in the sea) (Carr et al., 1974). Feeding grounds for the Ascension nesting population are located off the coasts of Brasil (Carr, 1975).

Migration The Ascension population migrates some 2000 km to and from foraging grounds off the coast of Brasil; the zone within which turtles tagged on Ascension have been recovered extends for around 3000 km from near São Luis, south to Vitoria (Carr, 1975). No turtles tagged elsewhere have ever been recovered at Ascension.

POPULATION: Eretmochelys imbricata

There are a very few records of this species in Ascension waters (R. Whitla in litt., 29 August 1986); no nesting is known to have occurred on the island.

THREATS

Mortimer (1979) reported that mining of beach sand was causing loss of habitat and disturbance to nests, and general human activity on the beach was causing disturbance and disorientation of hatchlings; Mortimer also urged that plans for tourist development be dropped. Sand mining and disturbance are still regarded as active threats at the present time (Fletemeyer, 1986; Mortimer, 1986), despite appropriate legislation; use of the island as a staging post during the 1982 Falklands/Malvinas war resulted in much additional disturbance and further mining of sand during construction work to lengthen the airstrip (Mortimer, 1986).

EXPLOITATION

Turtles were formerly exploited for food by passing sailing ships, the earliest documented record being 1600. In the eighteenth century, American ships were reported to be collecting cargoes of turtles to supply Barbados and Bermuda. A permanent British garrison was established in the early nineteenth century, after which, turtle collecting came under Government control. In one year, 2500 turtles were said to have been turned on the beaches, with a peak of 40-50 a night. In the 1840s and 1850s, 600-800 turtles were exported annually, falling to 300 in 1878. By 1920, only about 60 turtles a year were being exported, and there are no futher records after 1932. Eggs are not thought to have been collected to an appreciable extent, and the government-licensed turtle hunters were required to wait until the eggs had been laid before turning the female (Parsons, 1962). Werner (1912, cited in Loveridge and Williams, 1957) reported that turtles were kept in lagoons connected to the sea for use in the Commandant's mess and to be presented to visiting warships. The turtles nesting on Ascension are known to migrate to foraging grounds off north-eastern Brazil (q.v.) where they are subject to some level of exploitation.

ASCENSION AND ST HELENA

LEGISLATION

St Helena and its Dependencies, including Ascension Island, were covered by the UK ratification of CITES from 2 August 1976.

Wildlife (Protection) (Ascension) Ordinance (Cap. 129).
It is an offence to kill, capture, take or wilfully injure turtles or their eggs.

Ascension Land Ordinance, 1967.
The Governor may withhold consent at certain times for certain tracks to beaches to be used, and also for the mining of sand on beaches.

ST HELENA

Available information is sparse and, in part, conflicting. J.F. Rogers (*in litt.*, 29 September 1986) states that neither *C. mydas* nor *E. imbricata* nest in St Helena, while T.F. Richards (*in litt.*, 7 November 1986) states that both nest in small numbers. Both correspondents report that both species occur in low abundance in St Helena waters. Loveridge (*in litt.*, 1968, cited in Brongersma, 1982) said that *C. mydas* sometimes nested, and noted a record of *E. imbricata* (but did not indicate whether this was a nesting record or a record of the species's occurrence at sea). There is reportedly no exploitation of sea turtles.

AUSTRALIA: QUEENSLAND

POPULATION: Chelonia mydas

Nesting sites Raine Island and nearby cays, including Pandora, at the northern extremity of the Great Barrier Reef, and the Capricorn-Bunker island groups, at its southern extremity, are important nesting sites. The Wellesley Group, including Bountiful, Pisonia and Rocky, in the south-east Gulf of Carpentaria, is also an important nest area (Limpus, 1982). Nesting occurs at a much lower level at several other sites in the GBR and Torres Straits, including Bell Cay, Bushy Island, No. 7 and No. 8 Sandbanks, and Bramble Cay (Limpus, 1982). Bramble Cay is the largest Torres Straits rookery, but is minor compared with the Queensland Great Barrier Reef sites (Limpus and Parmenter, 1986).

Nesting numbers Several thousands of females usually nest each season at each of the three most important rookery areas: Raine-Pandora, Capricorn-Bunker, and the Wellesley Group (Limpus, 1982). This total comprises tens of thousands estimated to nest at Raine-Pandora, and about 5000 at each of the other two centres (Limpus and Fleay, 1983). Within the Capricorn-Bunker group, Northwest, Wreck and Hoskyn islands appear to hold the largest numbers, with around 20-100 females nightly at peak nesting (Limpus, Fleay and Guinea, 1984). Between 500 and 700 females appear to use Bramble Cay (Torres Straits) a season, which would suggest 50-80 nightly at peak nesting (Limpus, 1983). This is larger than the combined number nesting in other parts of the Torres Straits; a small proportion of nesting females have been recorded to shift between Bramble and other nearby cays within a season (Limpus and Parmenter, 1986).

Large-scale variation in annual nesting numbers has been recorded at Raine Island, where over 11 000 females were ashore on one night on the 1.7-km beach in 1974-5 and only around 100 nested nightly the following season (Limpus, 1982), and on Heron Island, where more turtles nested nightly in 1974-5 than ever before in living memory, but with very sparse nesting in 1975-6 (Limpus, Fleay and Guinea, 1984).

Trends in nesting numbers With one apparent exception, there is no evidence that present nesting numbers in eastern Australia differ significantly from levels recorded by early mariners in the area (Limpus, 1982). The exception is Bramble Cay in the Torres Straits, where several hundred nest at present, but according to local fishermen, numbers may have been an order of magnitude greater some 30 years ago, possibly with numbers comparable to those at Raine Island at present (Limpus and Parmenter, 1986). Limpus and Fleay (1983), however, reported that Torres Straits populations (breeding along the GBR) are being over-harvested and are on the decline, due primarily to more efficient hunting and the development of the Daru market in PNG (see below). They reported indicating that turtle hunters are having to travel farther to maintain catches.

Nesting season Nesting occurs between late November and January in southern Queensland.

Foraging sites The entire Great Barrier Reef area, while supporting very important nesting populations, which in part disperse to foraging areas outside Australian territory, also provides feeding grounds for populations which in part nest outside the Great Barrier Reef. See next paragraph.

Migration Tag return data demonstrate that the turtles nesting in the Capricorn-Bunker sector of the southern GBR forage mainly along the northerly sectors of the GBR, and around the Torres Straits islands, while more northerly nesters migrate further afield. Females nesting on Australian beaches have been captured in Indonesia, (Ambon, Aru, Irian Jaya), Papua New Guinea, Vanuatu and New Caledonia. It should be more widely recognised that these countries share a regional resource which should be managed on that basis.

POPULATION: **Eretmochelys imbricata**

Nesting sites There is sporadic nesting throughout the Gulf of Carpentaria (Limpus, 1982), including Crab Island (Limpus et al., 1983), low density nesting on almost every island in Torres Straits (Limpus and Parmenter, 1985) and also on the inner shelf islands of the northern Great Barrier Reef (Limpus, 1982). Long Island in the central Torres Straits group appears to be the most critical single site (Limpus, 1982), but Aukane, Mimi and Kabbikane are also important (Limpus and Parmenter, 1982). Milman and Bird Islands appear to be the most significant northern GBR sites (Limpus and Fleay, 1983).

Nesting numbers Although widely distributed in Queensland, the Hawksbill is nowhere abundant. Nesting numbers are generally small, with the exception chiefly of Long Island in the Torres Straits. Collectively, the central and eastern Torres Straits islands are of international importance for Hawksbill nesting (Limpus and Parmenter, 1985). According to Bustard (1974) up to 75-100 females may emerge on a single night on certain Torres Straits islands; this may refer to Long Island and Campbell Island, previously cited by Bustard (1972) as the pre-eminent Torres Straits Hawksbill rookeries. Nesting at this density has not subsequently been recorded by other observers (Parmenter, 1983); Limpus et al. (1983) recorded a mean of 1.2 emergences nightly on Campbell Island between 1 December 1978 and 16 February 1979.

Trends in nesting numbers No direct information; however, Limpus and Parmenter (1985) suggest that hatchling productivity may be too low, due to very heavy egg predation by man and varanid lizards, to maintain substantial Hawksbill populations into the future.

Nesting season Some nesting occurs throughout the year in the Torres Straits area, but with a peak in February (Limpus and Parmenter, 1985).

Foraging sites Small to moderate numbers of adult and immature Hawksbills live for most of the year around GBR islands but do not nest locally and are presumed to migrate to more distant nest sites (Limpus, Fleay and Guinea, 1984). Similarly, a largely resident foraging population, primarily adults, exists in the Torres Straits region; it is inferred that these turtles migrate to nest elsewhere.

Migration There is a single, but highly significant, published tag-return relating to Hawksbills in this area; a large adult female tagged while foraging in the Sakeman Reef area of the Torres Straits, about 3 km from the Campbell Island rookery, was recaptured about 10 months later and 1650 km distant while nesting on Kerehikapa in the Solomons (Vaughan, 1981).

EXPLOITATION

The main species hunted in the Torres Strait area is C. mydas, there being a widespread belief that the meat of E. imbricata is toxic (Kowarsky, 1982). The legislation prohibits turtle hunting except by the indigenous people, and hunting appears to be confined to the aboriginals and the Torres Strait islanders.

Commodities Meat, used for subsistence purposes, provides the major incentive for hunting, and Neitschmann (1984) considered that it was important in the diet of the Torres Strait islanders, although it is probably less so on the mainland (Kowarsky, 1982). Some turtles are used for their shells and as curios, for which a small tourist trade was reported on Thursday island (Kowarsky, 1982). Limpus and Parmenter (1986) described how E. imbricata is occasionally caught for its shell, some of which is used locally. Polished carapaces of this species and C. mydas are also traded. Egg collection is thought to be of minor importance, although it is carried out on a small scale (Kowarsky, 1982); however Limpus and Parmenter (1986) considered that it had a greater impact on E. imbricata.

Hunting intensity Kowarsky (1982) made estimates of the average annual catch of turtles in four communities in the Torres Strait, and these are given in Table 14. The total harvest by people living in Australian territory in the Torres Strait has been estimated to lie between 2100 (Neitschmann, 1984) and 4000 (Parmenter, cited in Kowarsky, 1982). There is also a considerable harvest conducted by boats from Papua New Guinea, which is not included in these totals and is discussed elsewhere.

Table 14. Estimates of the average annual per capita catch of turtles in four communities in the Torres Strait (Kowarsky, 1982)

Community	Harvest
Yorke	0.55
Mabuiag	1.28
Kubin	1.99
Badu	0.80

The indigenous population of the remainder of the Queensland coast within the areas where turtles are hunted is about 6500 and, using the lowest harvest in Table 14, Kowarsky (1982) estimated the total catch to be about 3500 turtles a year, giving a harvest for the whole state in the range 5000-8000.

The great majority of the turtles caught in the Torres Strait are female. Nietschmann (1984) found that in three communities over a 3-year period, 974 females were caught and only 21 males. Kowarsky (1982) reported a similar imbalance on Yorke Island, although there he found that the majority of females caught were immature. The mean weight of turtles caught by hunters at Mabuiag Island was 131 kg (Nietschmann, 1984). Kowarsky (1982) estimated the average weight for turtles caught in the region to be lower, at 100 kg. Because of the ban on sale of turtles in Australia, there is believed to be some selectivity of hunting. Torres Strait hunters were observed to catch

more turtles than they needed and then to release those that they did not want (Limpus and Fleay, 1983).

Kowarsky (1982) found that most of the turtle hunting was conducted during the mid-summer months on Yorke Island, but a detailed analysis by Nietschmann (1984) in the west of the region found no seasonality in landings.

Nietschmann (1984) reported that each turtle caught by Torres Strait Island communities involved a mean round-trip of 22.9 km and a total time of 1 hr 56 min. There are some indications that hunters have recently had to travel further to maintain their catch levels (Limpus and Fleay, 1983). Turtles are generally scarce around human settlements, and those that are present are usually small. This localised depletion has been attributed to selective hunting for large turtles (Limpus and Parmenter, 1986). Limpus and Parmenter (1986) concluded that there was a strong probability that the utilisation represented overharvest of the Torres Strait turtle populations, though it is not clear whether they referred only to the local harvest or whether the harvest of migrating turtles in other areas was to blame.

Opinions differ as to the significance of the egg harvest. Kowarsky (1982) reported that several of the respondents to his questionnaire survey claimed to collect fewer than 20 eggs a week, while two respondents gave estimates of about 1000 a week. There is no indication of which areas these reports refer to, but Limpus and Parmenter (1986) found that in the eastern Torres Strait almost every egg laid by E. imbricata was harvested on the inhabited islands, and many were also harvested on some of the uninhabited islands. Human egg predation was thought to be less severe in the west of the Strait, but there predation by varanid lizards was very heavy.

Hunting methods Most hunting is now carried out by harpoon from aluminium dinghies, powered by outboard motors, although dugout canoes were formerly used. Occasionally turtles are caught by hand in reef pools (Kowarsky, 1982).

Historical trends There is no direct evidence of the previous levels of hunting in the region, and inferences can only be made from what is known of the human demographic trends. The population of mainland Aboriginals has declined dramatically since the time of white settlement, from a total of 300 000 for the whole country to about 40 000 in 1965. The Torres Strait Island communities do not appear to have suffered a similar decline, the population being estimated to be 3000-4000 in the 19th century and to fall to slightly under 3000 by the end of the 20th century (Kowarsky, 1982). Improved hunting facilities, in the form of motor boats, nylon rope, steel harpoons, etc., have resulted in increased hunting pressure (Limpus and Fleay, 1983), but Kowarsky (1982) considered that these improvements may have been offset to a certain extent by the high cost of boats and fuel for outboard motors. A recent trend for Aboriginals to move back to their traditional clan territories and away from the main settlements may increase the reliance on turtles in the future. Kowarsky (1982) concluded that "it would be reasonable to presume that the hunting pressures in the past were at least as great, if not greater, than those existing today". There are verbal reports that the turtle population on Bramble Cay has declined over the last 30 years, and this is thought to be attributable to harvest by Papuan boats (Limpus and Parmenter, 1986). Parsons (1972) indicated that there was formerly ("half a century ago") a large fishery for E. imbricata in the Torres Strait which produced nearly 5000 lb (2273 kg) a year.

Domestic trade Commercial sale of turtle products is illegal in Queensland, and Kowarsky (1982) concluded that such sales were now insignificant. He reported the current value of an adult turtle to be $160, while in 1973 it was between $10 and $15. Nietschmann (1984) described how hunters in the Torres Strait distributed their catch amongst their kinsmen in different households without any money changing hands, although the cost of the fuel for the boats was born by the hunters. The total number of indigenous people living in the region who could potentially use turtle products was estimated to be 4500 in the Torres Strait communities and 7552 in the remainder of Queensland (Kowarsky, 1982).

International trade Export of turtle products from Australia has been illegal for some time, and none has been reported in the Australian Customs statistics. Imports of bekko (the shell of E. imbricata) and other tortoiseshell from Australia have been reported in Japanese Customs statistics, and these are given in Table 15. No trade has been reported since 1979. Some turtles hunted in Australian waters are landed in Papua New Guinea (q.v.). There is no other evidence of international trade in turtle products.

Table 15. Imports of turtle products to Japan from Australia reported in Japanese Customs statistics by weight (kg) and value (Y1000).

	1970	1971	1972	1973	1974	1975	1976	1977	1978
Bekko (kg)	1654	894	0	397	364	977	1087	192	0
" (Y1000)	10696	6125	0	5400	9254	12173	15396	4414	0
Other shell (kg)	0	0	0	0	0	0	0	0	6
" (Y1000)	0	0	0	0	0	0		0	188

LEGISLATION

Fisheries Act 1976 (Kowarsky, 1982)
All Cheloniidae and Dermochelydae are protected. An exemption to this rule is made for subsistence hunting by Aborigines and Torres Strait Islanders. Commercial hunting of turtles is prohibited.

Commonwealth Fisheries Act. 1952-74. Fisheries Notice No. 48
The taking of sea turtles is prohibited in proclaimed waters (i.e. outside the three-mile territorial limit). An exemption is made for traditional fishing by indigenous inhabitants of an external Territory. In theory this would prohibit the hunting by Australian Aboriginals, but in practice the Act is applied to allow their traditional hunting to continue.

Wildlife Protection (Regulation of Exports and Imports) Bill 1982
Prohibits the export of all species on CITES Appendix I except for scientific purposes or for captive-bred specimens.

RANCHING

In 1973, the Australian Government set up Applied Ecology Pty Ltd to undertake research into industries which were compatible with the way of life of the indigenous peoples. One of the projects that the company undertook was to establish turtle rearing farms on islands in the Torres Strait. Farms were originally set up on ten islands but soon these were reduced to eight (Thomson, 1979). In October 1973, Carr and Main (1973) reported that there were a total of 112 farmers, spread from Murray Island, on the Great Barrier Reef to Western Australia. C. mydas were seen on farms on Maer, Darnley and Yorke Islands, and a photograph is given of this species on Yam Island. E. imbricata was reported to be present on Kubin, Moa, Badu, Sue, Yam, Cocoanut and Yorke Islands. The oldest farms were said to be on Maer and Darnley Islands, where the turtles were said to be one to two years old, indicating that they had started in 1971. The C. mydas were intended primarily for human consumption, although some sale of carapaces was envisaged. The E. imbricata were to be used primarily for the production of small, stuffed turtles (Carr and Main, 1973).

Sources of stock In the early stages of the operation, eggs were procured from a variety of islands (Carr and Main, 1973), including Raine Island, but later collections were only made on Bramble Cay. On this island, eggs were taken only from areas of the sand spit which were regularly eroded, and this activity was therefore thought to have had a minimal effect on the wild population. The eggs were transported to the farms for incubation in styrofoam containers. It was found that hatchability was not reduced if the eggs were moved within six hours of laying, but that mortality increased to 100% if they were disturbed subsequently. There were also plans to maintain some adults for captive breeding, but these were never implemented (Thompson, 1979).

Husbandry Various husbandry techniques were experimented with, including impoundments on the foreshore, floating cages and a variety of tanks and ponds. The standard ponds adopted were 3-m diameter fibre-glass tanks for the hatchlings, and plastic swimming pools for the larger animals, roofed over to provide shade (Thompson, 1979). Water in the ponds was changed several times a day, which was a labour-intensive process (Carr and Main, 1973) until mechanical pumps were introduced (Thompson, 1979). The hatchlings were fed a diet of fish, but it was found necessary to add green vegetable material, either sea grass or terrestrial plants, to optimise growth. The sizes attained by hatchlings on the farms varied from 600 g to 1200 g after one year, 1700 g to 3100 g after two years, and 3000 g to 8000 g after three years.

After operating the farms for five years, Applied Ecology recommended that the experiment be discontinued for economic reasons, because the growth rate of turtles was so low that they had to be kept for too long before attaining slaughter weight.

AUSTRALIA: WESTERN AUSTRALIA

POPULATION: Chelonia mydas

Nesting Sites The Lacepede Islands are probably the most important nest site off the Kimberley coast, followed by Browse Island and Cassini Island (R.I.T. Prince in litt., 1 July 1988); the Dampier Archipelago and the Monte Bello Islands and Barrow Island, about 150 km west of the Dampier

Archipelago, all off the Pilbara coast, were cited as probable major rookeries by Limpus (1982). The importance of the Dampier Archipelago and Barrow has since been amply confirmed by Morris (1986). Important nesting also occurs at many beaches along the entire seaward (west) coast of North West Cape, some 100 km in extent and 450 km southward along the coast from Dampier, and at Shark Bay, notably the northern tip of Dirk Hartog Island, around 450 km further south (Johannes and Rimmer, 1984), although C. caretta probably predominates south of North West Cape. Nesting at Ashmore Reef was described as "minimal" (R.I.T. Prince in litt., 20 August 1987).

Nesting numbers Nesting density in the Kimberley area remains unknown in detail; the islands are probably "very important" (Morris, 1986). Tagging work begun in 1986 at the Lacepede Islands resulted in 1500 C. mydas being tagged in two years (R.I.T. Prince in litt., 1 July 1988). New data from work in progress on the Pilbara coast islands have been made available by Morris (1986). Green Turtles are the most common turtle along this coast and regular aerial surveys indicate that up to 1200 sea turtles, predominantly Greens, nest each night during the peak season (December-January) on the 40 km of suitable beach in the Dampier Archipelago. Some 500 of these 1200 use a 5-km beach on the west coast of Rosemary Island, with 85% (=425) being C. mydas, (the remainder Hawksbills, Loggerheads and Flatbacks) (Morris, 1986). The west coast of Barrow Island has "a similar density of nesting" (Morris, 1986).

Based on these data, it seems likely that on average several thousand Green Turtles and possibly many more, nest annually in Western Australia.

Trends in nesting numbers Although there is no long-term information, Prince (in litt., 1 July 1988) estimated that nesting at the Lacepede Islands was three to four times higher in 1987/88 than 1986/87. A smaller increase was suggested at Barrow Island.

Nesting season Peak nesting season is December-January in the Dampier Archipelago (Morris, 1986).

Foraging sites It has been suggested (Morris, 1986) that the Pilbara coast Greens migrate to feeding grounds in Indonesia; a tagging programme was initiated in 1986 by the WA Department of Conservation and Land Management. It is also possible that these turtles use other sites in Australia; large feeding-ground populations are known along the coast of northern Western Australia (Limpus, 1982) and non-nesting Green Turtles are "very commonly" seen in the Abrolhos Islands (the southern-most Indian Ocean coral reefs) midway between Shark Bay and Perth (Johannes and Rimmer, 1984). Prince (in litt., 20 August 1987) considered that the reefs around the Lacepede Islands provided important foraging areas.

Migration Two turtles tagged at Lacepede Islands have been recovered in waters off the Northern Territory. A further recovery was made at One-arm Point, King Sound, of a turtle tagged in Indonesia, indicating intermingling of the two populations (R.I.T. Prince in litt., 20 August 1987).

POPULATION: Eretmochelys imbricata

Nesting sites Relatively little information is available. Limpus (1982) states that the Dampier Archipelago may be an important nesting ground; this is confirmed by Morris (1986), who reports that the Hawksbill is "relatively common" along the Pilbara coast and nests in low numbers on many islands in

the Dampier area, as far south as South Murion Island. There are no confirmed nesting sites off the Kimberley coast, but at least one female has been noted nesting at the Ashmore Reef (R.I.T. Prince _in litt._, 1 July 1988).

Nesting numbers In the Dampier Archipelago, the Hawksbill use the same nest beaches as the Green Turtle, but in the ratio of approximately one to every ten Greens (Morris, 1986). Eight Hawksbills have been seen nesting together on Lowendal Island, and 2-4 on beaches in the Dampier Archipelago. These comparative data suggest a maximum of around 100 Hawksbills nightly, which would imply a total annual nesting contingent of at least a few hundred.

Nesting season No details available, but nests at least in December-January (Morris, 1986).

Foraging sites No details available, but tidal mangrove-lined creeks on islands and the mainland are thought to be important as refuge and feeding sites for juvenile turtles (Morris, 1986).

EXPLOITATION

A commercial fishery operated along the North West Cape Peninsula until 1971 (Johannes and Rimmer, 1984), but now turtle hunting is mostly restricted to aboriginal communities between Pt Hedland and Wyndham. _C. mydas_ is the main species hunted, there being reports of poisoning from the meat of _E. imbricata_ in north-western Australia (Kowarsky, 1982).

Commodities Most turtles are hunted for meat for subsistence purposes, but in this region of Western Australia there are good supplies of other wild products, such as game, shellfish, fish and vegetables, and so turtles are relatively less important than in northern Queensland.

Hunting methods Aluminium dinghies with outboard motors and harpoons are the main hunting techniques.

Hunting intensity Capelle (1979, cited in Kowarsky, 1982) estimated the total catch between Pt. Hedland and Wyndham to be 104 turtles a year. The total number of Aboriginals living in coastal Local Government Areas in Western Australia, and therefore who could legally catch turtles, was 8736 in 1976, but it is unlikely that most of these would ever do so (Kowarsky, 1982). The main hunting season is from mid-November to March, corresponding with the mating season. There are reports (Anon., 1987c) that Indonesian fishermen who have permission to land on Ashmore Reef have been regularly capturing turtles illegally. Sightings of 50-60 captured turtles awaiting transport are reported. Incidental capture by far-seas Taiwanese and Australian fishing fleets probably accounts for a significant number of turtles (R.I.T. Prince _in litt._, 20 August 1987).

Historical trends See general comments under "Queensland"

Domestic trade Commercial trade in sea turtle products is illegal in Western Australia, but some sale of turtle shells to tourists has been reported around the Broome area, where the numbers of visitors have been increasing recently (Kowarsky, 1982), although there is no evidence of increasing trade (R.I.T. Prince _in litt._, 20 August 1987).

LEGISLATION

Wildlife Conservation Act No. 77. 1950 + amendments.

All fauna, including sea turtles, are totally protected in the state, but people who are native under the definition of the Aboriginal Affairs Planning Authority Act, 1972 may take turtles for subsistence purposes on land outside sanctuaries. Sale of turtles is prohibited.

See also Commonwealth legislation under "Queensland".

RANCHING

As part of the turtle ranching project run by Applied Ecology Pty Ltd primarily in Queensland (q.v.), C. mydas farms were set up in 1973 at One-arm Point in the Bardi Aboriginal community using stock obtained from the Torres Strait and Lacepede Islands. Three farms were in existence in October 1973 and a further three were planned (Carr and Main, 1973), although all were closed down by early 1974, largely as a result of social upheavals (R.I.T. Prince in litt., 20 August 1987).

AUSTRALIA: NORTHERN TERRITORY

POPULATION: Chelonia mydas

Nesting sites No major Green Turtle beaches are known in the Northern Territory (Limpus, 1982).

Nesting numbers No details available; presumably nests in small numbers only.

Foraging sites Large numbers of C. mydas occur on feeding grounds throughout the Northern Territory coast (Limpus, 1982). An estimated 1000 Greens (mainly large females) were stranded by Cyclone Kathy (23 March 1984) on the south-west coast of the Gulf of Carpentaria, adjacent to the Sir Edward Pellew Islands (Limpus and Reed, 1985a). This would seem to be an important feeding area (two stomachs examined in detail contained the seagrass Halodule pinifolia almost entirely, with traces of H. uninervis and Halophila spinulosa; Halodule pinifolia appeared to be the primary diet of all other turtles examined).

Migration Four of the turtles stranded by Cyclone Kathy near the Sir Edward Pellew group had been tagged in previous years at the major Raine Island rookery, off north-east Queensland. These individuals would have covered at least 1057 km moving between the Sir Edward Pellew group and Raine Island, without (so far as is known) nesting at the large rookery at Bountiful, Pisonia and Rocky Islands in the south-eastern Gulf of Carpentaria; similarly, turtles on feeding grounds in the Great Barrier Reef do not necessarily breed at the closest rookery (Limpus and Reed, 1985).

POPULATION: Eretmochelys imbricata

Nesting sites Low density nesting has been reported at several sites (Limpus, 1982).

Nesting numbers No details available; apparently only small numbers nest.

Foraging sites Few details available; Hawksbills have been reported around the Sir Edward Pellew group, possibly a feeding (and nesting) area.

EXPLOITATION

Commodities Most turtles are hunted for meat for subsistence purposes but, at least on Bickerton Island, turtles form a fairly small percentage of the diet derived from wild products (Kowarsky, 1982). Previously, Cogger and Linder (1969, cited in Kowarsky, 1982) had reported that C. mydas formed a staple item of diet amongst the coastal Aboriginals.

Hunting methods See general comments under "Queensland".

Hunting intensity There are no estimates for the catch in the whole state, but at South Goulburn Island, the Aboriginal population of 200 take about three turtles a week. Kowarsky (1982) extrapolated these data to the 13 settlements of Aboriginals along the coast of the Northern Territory to conclude that the total catch would be in the region of 2000 turtles a year. The local Aboriginal Community in the Sir Edward Pellew group harvest a small number of Green Turtles (by harpoon) for subsistence use, probably around 30 a year (Limpus and Reed, 1985).

Historical trends See general comments under "Queensland"

Domestic trade Commercial trade in sea turtle products is not illegal in the Northern Territory but it is discouraged by the fishery authority (Kowarsky, 1982).

LEGISLATION

Fisheries Ordinance 1965-66 (Kowarsky, 1982)

Declares all waters closed against the taking of C. mydas, except certain specified areas. These correspond to the traditional native turtling areas.

See also Commonwealth legislation under "Queensland".

AUSTRALIA: ISLAND TERRITORIES

Green Turtles nest on most islands in the western Coral Sea; the Diamond Islets appear to be the most important of these. In the Indian Ocean, very small numbers nest on Christmas Island, and the turtles nesting in small numbers on North Keeling Island and one of the Ashmore Reef Islands are assumed to be Greens (Limpus, 1982).

POPULATION: Chelonia mydas

Nesting sites Carr et al. (1982) reported nesting at Great Inagua, with the best nesting beaches on the south-east coast; and at Little Inagua, Abaco, Grand Bahama, Walkers Cay, Long Island, Conception, Bimini, Cat Cay, and Gun Cay. Higgs (1984), however, did not confirm any nest sites in the Bahamas.

Nesting numbers Higgs (in litt., 21 August 1986) reported nesting in low abundance. Carr et al. (1982) considered nesting to consist of "small numbers" on Great Inagua, "somewhat greater numbers" on Little Inagua, and just a few individuals in Abaco. Bacon (1981) regarded nesting in the Bahamas as frequent.

Trends in nesting numbers Higgs in litt. (21 August 1986) considered the nesting population of C. mydas to be stable at present. According to Carr et al. (1982), the numbers of nesting turtles, in general, had greatly decreased during the past 50 years.

Nesting season June-September (Carr et al., 1982).

Foraging sites Higgs (1984) reported foraging throughout the Bahama Banks. According to Carr et al. (1982), Green Turtles of all sizes occurred year round at Great Inagua and were known to congregate in protected shallow water bays, or "creeks", which were often mangrove bordered. At Andros and Abaco, Carr et al. (1982) reported that juvenile Green Turtles were often seen and that at Abaco they occasionally entered saltwater mangrove creeks. Adult Green Turtles were not reported at Andros. Bacon (1981) noted common foraging in the Bahamas by both adults and juveniles.

POPULATION: Eretmochelys imbricata

Nesting sites Nesting was reported by Carr et al. (1982) on Great Inagua (mainly the south-east coast), Little Inagua, Andros, Abaco, Grand Bahama, Walkers Cay, Conception, Bimini, Cat Cay and Gun Cay. No nesting sites were confirmed by Higgs (1984).

Nesting numbers Higgs in litt. (21 August 1986) reported low abundance nesting. Carr et al. (1982) noted small numbers of Hawksbills nesting on Great Inagua, greater numbers nesting on Little Inagua, and sparse to moderate nesting on Andros and Abaco. Bacon (1981) reported frequent nesting in the Bahamas.

Trends in nesting numbers Higgs in litt. (21 August 1986) considered the nesting population of E. imbricata to be stable. Carr et al. (1982) reported a considerable decline in the numbers of nesting turtles during the past 50 years.

Nesting season According to Carr et al. (1982) Hawksbills nested all year round.

Foraging sites Higgs (1984) reported foraging all year round on the Bahama Banks. Carr et al. (1982) noted the occurrence of Hawksbills all year round at Great Inagua and the year round presence of juveniles at Andros and Abaco. Bacon (1981) considered foraging to be frequent by adults and juveniles in the Bahamas.

EXPLOITATION

Commodity Higgs (in litt., 21 August 1986) reported Green Turtle meat to be the major commodity derived from sea turtles in the Bahamas. Carr et al. (1982) noted that, on Andros and Abaco, Hawksbill was the preferred meat, and that turtles and their eggs were taken for subsistence use and for export, and tortoiseshell was exported raw or prepared for sale to tourists.

Hunting intensity During the period 1974-1977 Hawksbill was the species most commonly landed at Nassau, but from 1981 onwards the Green Turtle was landed in greater quantities (Table 16). The quantities of meat and shell which were estimated to have been produced between 1980 and 1982 are given in Table 17. Table 18 indicates the islands from which the turtles landed at Nassau were said to have originated. Carr et al. (1982) noted that approximately 30 turtles were caught annually at Inagua between 1970 and 1976. Nassau was by far the main port for landings of turtles, but significant quantities were also landed at other sites (Table 19).

Domestic trade Turtles and tortoiseshell from throughout the Bahamas were shipped to Nassau to be prepared for sale to tourists or for export; from 1966 to 1969 B$65 000 worth of tortoiseshell was landed at Nassau (Carr et al., 1982). Higgs (1984) reported the market price of Hawksbill and Green Turtle meat to be US$2.20 a kg and the price of Hawksbill shell to be US$44.00 a kg.

Table 16. Landings of sea turtles in the Bahamas. Figures for *C. mydas* and *E. imbricata* from various sources: 1974-1977 (Carr et al., 1982); 1980-82 (Higgs, 1984); 1983-85 (Higgs, in litt., 21 August 1986). The FAO catch statistics (in tonnes) for "Marine turtles, not elsewhere specified" are also given.

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
C. mydas	2877	4210	4610	4364	-	-	4006	9154	12346	10226	20370	32915
E. imb.	10000	12816	14326	17366	-	-	19769	7888	3856	8854	13194	5663
FAO (t)	38	29	30	33	46	26	26	26	29	28	46	

Table 17. Official statistics of turtle production in the Bahamas (1980-1982) based on landing statistics and export returns (Higgs, 1984)

PRODUCT	1980	1981	1982
C. mydas meat (kg)	801.3	1830.8	2469.2
E. imbricata meat (kg)	3953.9	1577.5	771.3
E. imbricata shell (kg)	651.1	?	860.7

Table 18. Green Turtle and Hawksbill landings in Nassau in 1976 and 1977 from various islands in the Bahamas (in kg of gutted weight). (Source: Bahamas Ministry of Agriculture, Food and Local Government, cited in Carr et al., 1982).

	Green turtle		Hawksbill	
	1976	1977	1976	1977
Abaco	115	36	663	305
Acklins	189	183	45	0
Andros	1127	1175	2576	3380
Berry Islands	379	141	680	182
Bimini, Gun Cay & Riding Rocks	0	464	478	3168
Cat Island	14	0	32	177
Eleuthera	926	231	1641	2219
Exuma Cays	66	0	193	293
Long Island	0	0	60	0
Mayaguana	0	0	0	0
New Providence	41	804	105	1029
Ragged Islands & Western Bank	1977	366	9729	6096
TOTAL	4834	3400	16202	16849

Table 19. Landing sites and estimated catches for C. mydas, E. imbricata and C. caretta (Higgs, 1984).

Landing Sites	Estimated Catches (kg)
Nassau N.P.	19000
Abaco (central)	200
Moores Island	3500
Andros (north)	2000
Great Exuma	250
Grand Bahama (west)	2500
Other inhabited islands	Unknown subsistence fishery

International trade The Bahamas acceded to CITES on 20 June 1979. CITES Annual Reports for the period 1977 to 1985 record imports to the United States from the Bahamas, of six C. mydas shells, three E. imbricata shells, four E. imbricata bodies, and one other item, all either illegally or for personal use; imports to Great Britain of two C. mydas shells; and exports from the Cayman Islands to the Bahamas of ten C. mydas shells and 30 lbs (13.6 kg) C. mydas meat.

Japanese Customs reports show imports of Bekko (E. imbricata) and other tortoiseshell from the Bahamas. The quantities are given in Table 20. There appears to have been a significant increase in 1978 and 1979, probably associated with the accession to CITES, but no shell has been reported as having originated in the Bahamas since 1982.

Table 20. Imports of bekko and other tortoiseshell from the Bahamas reported in Japanese Customs statistics (kg). No imports were reported in other intervening years between 1950 and 1986.

	1954	'57	'58	'59	'60	'61	'62	'63	'64	'65	'66	'67	'68	'69
Bekko	23	8	2746	2453	1563	911	456	345	368	204	739	680	360	239
Other	-	-	-	-	-	-	-	-	57	16	0	14	55	0

	1970	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81	'82
Bekko	127	109	1474	580	218	449	532	922	1018	1866	767	29	728
Other	9	40	0	0	0	0	0	0	0	0	0	0	0

LEGISLATION

The Marine Products (Fisheries) Rules, 23 September 1954

The capture of turtles eggs is prohibited. The sale of turtles or turtle shells is subject to examination of the animal or shell by an authorised officer. Minimum harvestable size limits (Neck scales-tail pieces) have been set for E. imbricata of 17" (43 cm) and for C. mydas of 15" (38 cm). A closed season is set for C. caretta from 1 April to 30 June. [These rules have now been superseded].

The Wild Animals (Protection) Act 1968, LE 1154

It is prohibited to export, or attempt to export, any wild animal without a licence from the Minister.

Fisheries Resources (Jurisdiction and Conservation) Regulations 3 March 1986.

The capture and possession of E. imbricata is prohibited. An annual closed season for all other species of sea turtle extends from 1 April to 31 July. Minimum harvestable size limits have been set of 24" (61 cm) back length for C. mydas and 30" (76 cm) for C. caretta. All turtles must be landed whole. The taking or possession of turtle eggs is prohibited.

Green Turtles are reported to feed off the Bahrain coast (Gallagher, 1971), and one or two are washed up dead annually (source in Ross and Barwani, 1982). There is no information on the occurrence of nesting (Ross and Barwani, 1982). A recent field project concerned with the coastal environment in Bahrain (IUCN, 1986a) sighted six unidentified turtles off shore during a survey by helicopter, but found no evidence of nesting.

EXPLOITATION

Green Turtles are said not to be caught or consumed in Bahrain (Ross and Barwani, 1982).

Bahrain is not a Party to CITES, but CITES Annual Reports contain two records of trade involving sea turtles. In 1983, Switzerland reported importing one shell of E. imbricata from Bahrain, and in 1982 the Cayman Islands exported 3000 lbs of C. mydas meat to Bahrain.

LEGISLATION

There is reported to be no legislation affecting turtles in Bahrain (Ross and Barwani, 1982).

BANGLADESH

POPULATION: Chelonia mydas

The species is said to be common (Khan, 1982) or fairly common (Sarker and Sarker, 1985) in coastal areas of Bangladesh. Khan (1985) reported that C. mydas was a regular visitor to St Martin's Island, where it nested between October and February. Other reported sites were Katka, Supati, Nilkamal, Dubla and Putney (Khan, 1986). Rashid (1986) noted nesting on St Martins Island between mid-November and mid-February, a maximum of 35 nests being observed in a single night, although ten nests was more usual. Nesting also occurs on mainland beaches, the species being relatively more abundant than L. olivacea. Reported nesting in the Sundarbans area remains to be confirmed.

POPULATION: Eretmochelys imbricata

According to Khan (1982) and Sarkar and Sarker (1985), E. imbricata is uncommon in Bangladesh. Rashid (1986) reported that Hawksbills occasionally nest on St Martin's Island, two individuals being observed in 1984.

EXPLOITATION

Commodity The native people, especially the non-Muslims, are said to be fond of turtle eggs and to collect them, and occasionally nesting adult turtles, along the coasts and islands, mainly for local consumption (Sarker, 1982; UNEP, 1986). The main area for egg collection is among the tribal communities in Chittagong (Fugler, 1983).

Hunting intensity "Thousands" of eggs are said to be collected every year (Sarker, 1982), and this is said to have created a "conservation problem" (UNEP, 1986). The level of female predation is not known, but Sarker (1982) said that the egg collectors "sometimes even kill the female turtles". Kahn (1985) reported that there were some two dozen islanders engaged in collecting turtle eggs on St Martin's Island.

Hunting methods As far as is known, there is not an offshore fishery for sea turtles, and females are only killed on the nesting beaches. Egg collecting is usually carried out by children and those without other employment, but is said to be becoming more professional (Rashid, 1986).

Domestic trade Sarker (1982) reported that professional egg collectors sell the eggs in the local markets at a low price. Rashid (1986) noted that eggs were sold to tribal people and non-muslims for TK40-50 per 100 (TK32 = US$1).

International trade Fugler (1983) reported that there was no international trade in sea turtle products, although large quantities of fresh-water turtles were exported to eastern markets, particularly Hong Kong and Singapore. The Customs statistics of Hong Kong and Singapore both report imports of "tortoiseshell" from Bangladesh, but it seems likely that this represents the shell of freshwater species, which is used for medicinal purposes. Bangladesh export statistics record the export of between TK22 million and TK42 million a year since 1981 of turtles and tortoises, but Rashid (in litt., 16 October 1988) confirmed that this represented mostly freshwater turtles. There is said to be some bartering of turtle eggs in Chittagong with Burmese people (Rashid, 1986).

CITES Annual Reports contain no record of trade in sea turtle products with Bangladesh.

LEGISLATION

Sea turtles are not protected in Bangladesh; and none is listed in the Wildlife Preservation (Amendment) Act, 1973.

BARBADOS

POPULATION: *Chelonia mydas*

There are no reports or records of Green Turtles nesting on Barbados (Hunte, 1984) and foraging individuals occur in low abundance (Bynoe *in litt.*, 24 September 1986).

POPULATION: *Eretmochelys imbricata*

Nesting sites Bynoe (*in litt.*, 24 September 1986) reported Hawksbill nesting from Fitts Village to Speightstown, on the west coast; at Rockly/Accra and Worthing Beach, on the south coast; and at Bath and Crane on the east coast. Nesting was also reported at Cattlewash Beach on the north-east coast and Foul Bay Beach on the south-east coast (Hunte, 1984).

Trends in nesting numbers Turtles reportedly nested on all sandy beaches but now do so more rarely, and are particularly rare on the more developed west and south coasts (Hunte, 1984). Whilst only *Eretmochelys* nests at present, it is unknown whether other species nested in the past.

Nesting season Primarily May-October (Hunte, 1984).

EXPLOITATION

Commodity The major commodities obtained were meat from the Green Turtle and meat, eggs and shell products from the Hawksbill (Bynoe *in litt.*, 24 September 1986).

Hunting intensity The mean number of turtles caught per fisherman was two per month; there were 29 landing sites for "exploited marine stocks" (Hunte, 1984).

Hunting methods Trammel nets were, in the past, set frequently off the east coast, but this apparently no longer occurs. The nets now used range between 8" and 12" (20-30 cm) square mesh, are 8-12 ft (2.4-3.7 m) deep and 20-150 m long. They are set near the surface, on the bottom, or on bars (Hunte, 1984). Hunte (1984) also reported that data indicated a general decline in turtle landings on Barbados and that many fishermen interviewed believed that the turtles they caught were smaller than in the past.

Domestic trade Bynoe (*in litt.*, 24 September 1986) reported domestic trade in shell products.

International trade Japanese imports of bekko from Barbados are given in Table 21.

CITES annual reports for the period 1977-1985 record imports to the United States from Barbados of 11 shells, three carvings, three bodies and a consignment of meat; imports to Canada, from Barbados, of two bodies; the import by UK of one shell; and the export to Barbados of 15 cartons of soup from UK. Barbados is not a party to CITES.

RANCHING/HATCHERIES

An experimental attempt at rehabilitation has been conducted on the east coast of Barbados, approximately 630 Hawksbills being reared from eggs and then released when between eight and nine months of age (Hunte, 1984).

LEGISLATION

Fisheries Regulation Act, Cap. 131 19 August 1904.

It is prohibited to capture or attempt to capture turtles or turtle eggs on the shores or within 100 yards (91 m) of the shore.

The setting of nets or traps for the purpose of catching turtles is prohibited within 100 yards of the shore.

It is prohibited to buy, sell or expose for sale, or to possess for the purpose of selling, any turtle weighing less than 30 lb (13.6 kg) which has been taken contrary to the regulations.

Table 21. Japanese imports of bekko (kg) from Barbados, recorded in Japanese Customs statistics. No imports were recorded in the intervening years between 1950 and 1986.

1956	'57	'64	'70	'71	'72	'73	'74	'75	'76	'78	'79	'80	'82	'86
5	12	64	398	338	337	344	310	31	13	23	9	9	11	116

POPULATION: Chelonia mydas

Nesting sites No sites of concentrated nesting appear to exist; most nests seen by Moll (1985) were isolated single nests, and most were on beaches of offshore cays rather than on the mainland, much of which bears mangrove vegetation. Known nest sites include Ambergris Cay, Half Moon, Sapodilla Cays and Glovers Reef (Miller, 1984); also the Placencia Peninsula, Pompion Cay and South Silk Cay (Moll, 1985).

Nesting numbers Aerial and beach surveys reported by Miller (1984) resulted in an estimate of around 20 C. mydas nesting annually. Moll (1985) recorded five nests in June-July, 1983. Although surveys are not complete, the C. mydas nesting population appears to be extremely small.

Trends in nesting numbers Few details are available. Although there is no evidence that large numbers of C. mydas nested in the past, Carr et al. (1982) reported several sites where the species formerly nested but now does so only sporadically, or not at all. This suggests that some decline in the nesting population may have occurred.

Nesting season The sparse nesting reported by Miller (1984) was observed in June-August, while Moll (1985) was informed that some nesting may occur throughout the summer.

Foraging sites Whilst nesting is of little significance, Belize, with a barrier reef network extending the length of the coast, provides very extensive foraging grounds (Carr et al., 1982; Moll, 1985). Young C. mydas are moderately common in the central and southern areas; all age groups were frequently seen over the near-shore shallows, where vast beds of sea grass exist (Moll, 1985).

Migration No turtles have been tagged in Belize. Two females tagged at Tortuguero (Costa Rica) have been recovered in Belize waters.

POPULATION: Eretmochelys imbricata

Nesting sites No sites of concentrated nesting appear to exist; most nests seen by Moll (1985) were isolated single nests, and most were on beaches of offshore cays rather than on the mainland, much of which bears mangrove vegetation. Known nest sites include Long Cay, Placencia, Ranguana Cay, Pompion Cay, the Sapodilla Group, Glovers Reef and Southwest Cay (Miller, 1984; Moll, 1985). The Sapodilla Cays group in extreme southern Belize appears to be perhaps the most important Hawksbill nesting area.

Nesting numbers Surveys reported by Miller (1984) resulted in an estimate of around 30 E. imbricata nesting annually. Moll (1985) recorded eight nests in June-July 1983. Although surveys are incomplete, the E. imbricata nesting population appears to be very small.

Trends in nesting numbers No information. Carr et al. (1982) reported that turtle nesting (in part, at least, by C. mydas) has virtually ceased at some locations due to disturbance; this nesting may have included some E. imbricata.

Nesting season Nesting reported by Miller (1984) occurred in June-August; Moll (1985) was told that Hawksbill nesting also occurred (in the Sapodilla Cays) in August-September.

Foraging sites Whilst nesting is of little significance, Belize, with a barrier reef network extending the length of the coast, provides very extensive foraging grounds (Carr et al., 1982; Moll, 1985). Young E. imbricata were reported to be moderately common (Moll, 1985) in central and southern areas of the reef, and were also reportedly found near Ambergris Cay, in the north. Hawksbills of all ages are found mainly over the reef itself, rather than the inshore shallows or the deep water outside the reef (Moll, 1985).

THREATS

Exploitation of eggs and turtles appears to be prevalent but its impact on turtle populations is unknown. Shrimp trawling is reported to cause turtle mortality (Carr et al., 1982), although no quantitative details are available.

EXPLOITATION

Commodity All three species of turtle are caught for private consumption and commercial sale in Belize. C. mydas is the preferred meat and C. caretta is considered inferior. E. imbricata is not generally eaten but is caught for its shell (Moll, 1985).

Hunting intensity Miller (1984) made estimates (from market surveys and interviews with fishermen) of the numbers of turtles caught in Belize, and these are shown in Table 22. Some 20-30 people were said to be full-time turtle fishermen. One fisherman at Mullins River is said to catch 4-5 turtles a week during the legal season. Turtles are also caught during the close season but they are distributed clandestinely (Moll, 1985). There is also an incidental catch of turtles by the growing shrimp fishing industry (Carr et al., 1982). The eggs of all species of turtle are said to be gathered whenever possible (Carr et al., 1982; Moll, 1985). Miller (1984) put the estimated annual harvest at 10 000 eggs.

Table 22. Estimated catch of sea turtles in Belize (Miller, 1984).

Species	1980	1981	1982
C. mydas	350	325	280
E. imbricata	360	370	325
C. caretta	415	425	400

Hunting methods Some turtles are caught in nets set in the seagrass beds (Moll, 1985).

Historical trends There is no information on the local harvest, but the incidental catch in shrimp trawls is said to have started only in 1978 (Carr et al., 1982).

Domestic trade Turtle meat is sold locally during the open season but are distributed door-to-door at other times. Eggs are sold for export.

International trade Moll (1985) indicated that turtle eggs are illegally exported for sale in Honduras and Guatemala. Export of turtle products was banned in 1977, but in the 1970s shell were exported to France. Japanese Customs statistics have regularly recorded small imports of bekko (E. imbricata from Belize from 1956 onwards, but rapidly increasing volumes in 1985 and 1986 (Table 23). Furthermore, an analysis of the import records of Japanese shell dealers showed that a total of 1628 kg, 3240 kg and 3280 kg were imported from Belize in the three years 1984 to 1986 (Milliken and Tokunaga, 1987a). Thus, not only is the import increasing, but the Customs statistics appear seriously to underestimate the true volume of trade. It is possible that the clamp-down on other ports of export of turtle shell in the Caribbean has caused the trade to shift to Belize.

Belize was originally covered by the UK acceptance of CITES in 1976, but following independence in 1981 it was not certain whether separate ratification was necessary. Clarification has now been received indicating that Belize is considered to have been a Party continuously since 1976. The only record of trade in turtle products originating in Belize contained in CITES Annual Reports is the illegal import of a total of 69 shell products, three leather items and 5 lb of soup to the USA between 1977 and 1984. Italy also reported re-exporting five handbags made of C. mydas leather which had originated in Belize.

Table 23. Imports of bekko (kg) from Belize reported in Japanese Customs statistics. No trade was reported in the intervening years between 1950 and 1986.

Year	1956	1958	1959	1960	1961	1962	1963	1966	1967	1969	1970
kg	17	147	495	204	241	219	112	222	209	243	97

Year	1971	1973	1974	1976	1977	1979	1980	1982	1983	1985	1986
kg	82	28	279	12	40	314	258	702	538	1195	2231

LEGISLATION

Wildlife Protection Ordinance 1944.
- Hunting of any animal is prohibited without a licence.
- Import and export are prohibited without a licence.
- [REPEALED by the Wildlife Protection Act 1981.]

Fisheries Regulations No. 66, 1977.
- Prohibits the taking or possession of turtles from 1 June to 31 August.
- Prohibits the taking or possession of turtle eggs.
- Prohibits the setting of nets within one hundred yards of the shore with the intent of taking turtles.
- Prohibits the taking, capturing, buying, selling or possession for the purpose of selling, of turtles under certain weights:

C. caretta	30 lb (13 kg)
C. mydas	50 lb (23 kg)
E. imbricata	50 lb (23 kg)

- Prohibits the export of turtle products.

Wildlife Protection Act 1981 (25 November 1981).

Refers to all parts, eggs and nests. A seven-year moratorium on the sale or on any dealing for profit in any wildlife species or parts or products thereof is established as from the date of entry into force of this act. Importation or exportation of wildlife requires a permit. Hunting in listed species is prohibited. All reptiles other than protected species may be taken with a licence.

Protected species:

C. caretta
C. mydas
E. imbricata
D. coriacea

These four species of turtles have been deleted, since then, under Statutory Instrument No. 12 of 25 January 1982, and therefore hunting is now allowed with a licence.

BENIN

No information available. Marine turtle nesting has been reported near Ouidah (source cited in Brongersma, 1982), but the species and numbers involved are unknown.

International trade Benin acceded to CITES on 28 February 1984. There is no record of trade in turtle products with Benin recorded in CITES Annual Reports.

LEGISLATION

Decree concerning hunting and capturing licences, bag limits and professional hunters. 11 February 1980.
Prohibits the possession and commercial trade of sea turtles.

POPULATION: Chelonia mydas

Nesting sites There is probably no nesting on Bermuda today. Bacon (1981) considered nesting to be occasional but cited only one incident of Green Turtle nesting, at Warwick in 1955. There are no other available reports of Green Turtle nesting on Bermuda.

Nesting numbers See above.

Trends in nesting numbers As early as 1620 Green Turtles had become sufficiently rare for the Bermuda assembly to pass an act prohibiting the killing of turtles less than 18" (45.7 cm) in width or length (see King, 1982). Turtle fishing continued, however; the rookery aggregations became extinct and by 1934 no turtles at all nested on Bermuda (King, 1982).

Foraging sites Foraging Green Turtles were reported to be of medium abundance (Burnett-Herkes in litt., 18 November 1986). Burnett-Herkes (1984) also reported over 1000 Green Turtles to be foraging around the Bermuda Islands.

POPULATION: Eretmochelys imbricata

Nesting sites Burnett-Herkes in litt. (18 November 1986) reported no Hawksbills nesting on Bermuda. Bacon (1981), however, considered nesting of this species to be occasional but did not cite any examples.

Nesting numbers See above.

Foraging sites Foraging Hawksbills were reported to be of low abundance (Burnett-Herkes in litt., 18 November 1986). Burnett-Herkes (1984) also reported the number of Hawksbills foraging around Bermuda to be greater than 50.

EXPLOITATION

Burnett-Herkes (in litt., 18 November 1986) stated that there was no harvest of indigenous sea turtle populations in Bermuda. In the past, Green Turtles were caught in nets, harpooned, and captured when they came ashore to nest (King, 1982). Garman (1884, cited in King, 1982) reported that two boats were able to catch 40 turtles a day but 50 years later only 20-60 immature turtles were netted annually (Rebel, 1974, cited in King, 1982). In 1970, 25 immature turtles were captured (King, 1982).

CITES Annual Reports for the period 1977-1985 record exports to Bermuda of two bodies and four shells of C. mydas from the Cayman Islands and 2000 eggs (C. mydas) from Costa Rica; the import to Bermuda of 960 cans of soup from the UK; and the import from Bermuda by the USA of 25 "specimens" of C. mydas. Bermuda is covered by the UK's ratification of CITES (2 August 1976).

RANCHING/HATCHERIES

An experimental hatchery has been operated at Castle Harbour since 1967 in an attempt to re-establish wild turtle populations.

BERMUDA

Between 1967 and 1977, over 17 000 Green Turtle eggs were transplanted to Bermuda from Costa Rica. From these 10 000 hatchlings were released and 450 were retained for two years for headstarting, tagging and release. In 1981, 3048 Green Turtle eggs were imported from Suriname, 346 being subsequently hatched and released. Also in 1981, 42 Green Turtle hatchlings were released from eggs laid at a natural pond known as "Devil's Hole". In 1976, 252 eggs had been laid at the same pond but none hatched (Burnett-Herkes, 1984).

LEGISLATION

Given protection more than 350 years ago, when all turtles less than 18" were protected.

Fisheries Act 1972, No. 76. (22 June 1972).
The Minister is empowered to prohibit the taking of any species of fish, including turtles, in the Territorial limits.

Fisheries Order 1973.
Turtles protected within old 12 mile territorial limit for a five-year trial period
[Expired 1 April 1978].

Fisheries (Protected Species) Order 1 April 1978.
Taking of all sea turtles is prohibited within the 200-mile fishing zone of the Island.
The import and export of turtles is prohibited under the terms of the Fisheries Act.

The Fisheries Act 1972 Amendments Consolidation Order 1985 (29 December 1985).
In addition to "taking" the Minister is empowered to prohibit "attempting to capture, kill or destroy" any fish.

POPULATION: Chelonia mydas

Nesting sites According to Schulz and Reichart (1980) and Reichart (1984) sea turtle nesting occurs on practically all beaches on the north and north-east coasts of Brazil, south at least to Espirito Santo. Reichart records C. mydas nesting in many states, from Para in the north, south through Maranhao, Piaui, Ceara, Rio Grande do Norte, Pernambuco, Alagoas, to Bahia; C. mydas is said to be the predominant nesting species in Para and Maranhao, but to be outnumbered by E. imbricata toward the south. On the other hand, after extensive fieldwork over the past few years, Marcovaldi (in litt., 12 September; 20 October 1986) considers mainland nesting by C. mydas to be insignificant, but reports nesting by this species on Brazil's oceanic islands: Ilha de Trindade, Atol das Rocas and Arquipélago de Fernando de Noronha. Much of the mainland nesting is by Loggerhead Caretta caretta (Marcovaldi, in litt.).

Nesting numbers On present information, nesting by C. mydas on mainland Brazil is widely scattered, but has been variously reported to involve significant numbers (Schulz and Reichart, 1980; Reichart, 1984), or to be very insignificant, with only 2-3 emergences per season at each site (Marcovaldi, in litt., 1986). The Projeto TAMAR team (Projeto Tartaruga Marinha; Marcovaldi, in litt., 1986) has surveyed much of the Brazilian coast, but found significant C. mydas nesting only on the oceanic islands (see Table 24). Bullis (1984) suggests that the breeding population (apparently total, not annual) in Brazil comprises more than 4000 females; on available evidence, this seems likely to be a very great overestimate.

Table 24. Main confirmed C. mydas nest sites in Brazil, with maximum nightly nesting numbers and suggested trends (data from Projeto TAMAR surveys, Marcovaldi, in litt., 12 September; 20 October 1986).

Location	Number, length of beach	Peak nightly emergence	Trend
Ihla de Trindade	3 beaches, each 1 km long	up to 50	stable
Atol das Rocas	1 beach, 1 km	6-9	declining
Arq. de Fernando de Noronha	-	(20 per year)	has declined

Trends in nesting numbers According to Marcovaldi (in litt., 1986), and as noted in Table 24, numbers at the important Ilha de Trindade site appear to be stable, but to be declining at Atol das Rocas; Fernando de Noronha may have been more important in the past. In general, C. mydas nesting numbers are said to be declining (G. and M. Marcovaldi, 12 September 1986, response to questionnaire). No further information on these reported trends is available.

Nesting season In general, most C. mydas nesting in Brazil appears to occur in September to March on the mainland, and December to April in the oceanic islands (M.A. Marcovaldi in litt., 10 August, 1988).

Foraging sites Marcovaldi (in litt., 20 October 1986) reports that juvenile C. mydas are abundant on foraging grounds along the mainland coast; similarly, Reichart (1984) reports that foraging C. mydas occur off all coastal states from Para south to Bahia, also in the Arquipélago dos Abrolhos.

Migration Brazil provided the classic documented example of an important feeding area being shared by two discrete populations that, in this case, migrate to nest in Suriname and on Ascension Island (Carr, 1975).

POPULATION: Eretmochelys imbricata

Nesting sites E. imbricata nests in all mainland states between Para and Bahia, with numbers generally greater toward the south (Schulz and Reichart, 1980), although this species was said to outnumber C. mydas in Para, in the north (Reichart, 1984). On the other hand, the Projeto TAMAR team only found significant Hawksbill nesting on the Bahia coast, notably at Praia do Forte and adjacent beaches, extending to some 60 km in all (Marcovaldi, in litt., 12 September). In contrast to C. mydas, no nesting is recorded on the oceanic islands (Marcovaldi in litt., 20 October 1986).

Nesting numbers Around ten females a season nest in the Praia do Forte region, Bahia (Marcovaldi in litt., 12 September); this is reportedly the main known nesting site in Brazil, so the total nesting population must be very small. On available information, the suggested figure of more than 800 females in the breeding population (Bullis, 1984) seems likely to be an overestimate.

Nesting season In general, most E. imbricata nesting in Brazil appears to occur from December to April (M.A. Marcovaldi in litt., 10 August 1988).

Foraging sites Suitable foraging grounds appear to be widespread off north-east Brazil (Reichart, 1984) and juveniles are commonly seen in mainland waters (Marcovaldi in litt., 1986).

THREATS Marcovaldi (in litt., 1986) notes that both C. mydas and E. imbricata are heavily exploited along the mainland: the former for meat; the latter for shell. He implies that mainland nesting is very sparse due to sustained exploitation pressure and, perhaps, disturbance.

EXPLOITATION

Commodity C. mydas is exploited for meat, and its carapaces are used for household decoration. E. imbricata is hunted for its shell, which forms the basis of a small artisan industry. Turtle eggs are also collected on the mainland (Marcovaldi in litt., 12 September 1986).

Hunting intensity Schulz and Reichart (1980) inferred from seeing shells on sale that turtle hunting still took place in Alagoas and Bahia. According to figures supplied by the Superintendencia do Desenvolvimento do Nordeste (SUDENE) the main turtle fishing states are Pernambuco, Ceara and Rio Grande do Norte (see Table 25). In Ceara, he estimated that the catch of C. mydas and E. imbricata was as much as 30 turtles a day at Almofala, and a fisherman at Icapui claimed to catch 200 C. mydas a year. The incidental catch of C. mydas in fish weirs may be quite high. The 1000 or so weirs in

Para are said to catch 0.2-0.3 turtles each a day at the height of the season (January-May), and the 100 weirs in Ceara may each catch three a day (Reichart, 1984). Before the establishment of Projecto TAMAR, about half of the Hawksbills which arrived to nest at Praia do Forte, Bahia, were killed and all their eggs were taken. The conservation project has greatly reduced the predation (Marcovaldi in litt., 12 September, 1986).

Table 25. Reported catches of E. imbricata (E i) and C. mydas (C m) in kg in coastal Brazilian states from 1976 to 1978. Figures supplied by Superintendencia do Desenvolvimento do Nordeste (SUDENE) Dept. do Recursos Naturais, Recife (Reichart, 1984).

	1976		1977		1978	
	E i	C m	E i	C m	E i	C m
Maranhao	-	-	100	-	150	-
Piaui	67	594	48	1530	44	985
Ceara	58	5333	113	3167	51	2016
Rio Grande N	4186	-	1026	677	244	1239
Paraiba	208	-	107	-	45	-
Pernambuco	223	17483	15	1213	-	467
Alagoas	7	-	-	-	369	-
Sergipe	?	?	?	?	72	-
Bahia	?	?	90	1812	-	400

Hunting methods The major method of turtle capture is probably by turning females on the beaches. Some turtles are caught accidentally in fish weirs. Prior to the ban on turtle capture in 1978, special large-mesh turtle nets were used, but their use was thought to have been largely discontinued (Schulz and Reichart, 1980). However, Reichart later (1984) reported that floating, hanging nets and baited longlines were still in use in Ceara. Similar nets are used by shark fishermen, and these may catch some turtles (Schulz and Reichart, 1980).

Historical trends Turtle hunting has evidently been carried on for many years as the decline in turtle populations is seen as a chronic problem. FAO fishery statistics for estimated catches of turtles from 1967 onwards are given in Table 26.

Table 26. Catches of "marine turtles not elsewhere specified" estimated in FAO fishery statistics (t) from 1965 to 1984.

1965	'66	'67	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81	'82	'83	'84
<50	<50	100	100	<50	<50	100	100	100	41	40	29	39	35	14	59	57	22	18	10

Domestic trade About 99% of all of the sea turtle carapaces seen in houses and restaurants were said to be C. mydas. There is a relatively well organised market for E. imbricata shell, and at least one workshop using this material in Maceio City, Alagoas (Marcovaldi, in litt., 12 September

1986). Schulz and Reichart (1980) reported "an abundance of stuffed Hawksbill and carapace products" on sale in Maceio and Salvador.

International trade Brazil ratified CITES on 6 August 1975. The only records of trade in sea turtles involving Brazil contained in CITES Annual Reports were imports to the USA of four shells of C. mydas and 28 items of E. imbricata. The UK also reported exporting six carvings of C. mydas to Brazil in 1982.

The Customs reports consulted contained no record of any trade in turtle products with Brazil.

LEGISLATION

Ley No. 5197, 3 January 1967

The collection, hunting, transportation or capture of wild animals is prohibited, except for scientific purposes or exhibitions at specialised scientific institutions upon official authorisation.

The export of raw reptile skins is prohibited.

[This law does not apply to fish which, together with other aquatic animals, are regulated under Ley No. 221; however some sea turtles are included in the list of protected species].

Portaria No. 303, 29 May 1968, superseded by Portaria No. 3481, 31 May 1973

A regulation issued to implement Ley No. 5197, setting out a list of protected species, recognised as threatened with extinction. They are given total protection, and may not be hunted or exploited in any way. Exports are also prohibited. The list includes E. imbricata and D. coriacea.

Ley No. 221, 22 February 1967

Controls the exploitation of freshwater and marine species, by means of several Portarias.

Portaria No. 109, Sports fishing, 31 March 1969.

The taking of the following species by sport fishermen is prohibited: C. caretta, C. mydas, E. imbricata and D. coriacea.

Portaria No. 18, Capture of sea turtles, 29 October 1976

Prohibits the disturbance of sea turtles at their nesting sites.

Prohibits the capture, commercialisation, transport or keeping of all species of sea turtle and their eggs except C. mydas and C. caretta.

Fishing for these two species is permitted only between 1 May and 30 November, subject to the following minimum size limits:

C. mydas	80 cm
C. caretta	70 cm

Portaria No. 27, Hunting, 14 September 1982.

Prohibits the taking, disembarcation, transport, sale or detention of C. caretta, E. imbricata, L. olivacea and D. coriacea

Prohibits the collection of eggs of any species of sea turtle.

Prohibits the disturbance of any species of turtle on the nesting beach.

Prohibits the taking of C. mydas of less than 80 cm.

C. mydas may not be caught with nets having a mesh size of less than 2 m or between 1 October and 30 April.

[Supersedes Portaria No. 18].

Portaria No. N-005, 31 January 1986.
The capture of all species of sea turtle is prohibited.
Sea turtles may not be disturbed on the nesting sites and the collection of their eggs is prohibited.
[Supersedes earlier portarias].

RANCHING/HATCHERIES

Since 1982, Projecto TAMAR has operated hatcheries in Praia do Forte, Comboios, Pirambu, Interlagos and Fernando do Noronha, at which they incubated totals of 51 385, 23 997, 21 937, 9650 and 5334 eggs respectively over the three years from 1982 to 1985. The eggs are removed from unprotected beaches and transferred to hatching facilities (Marcovaldi in litt., 20 October 1986).

POPULATION: Chelonia mydas

Nesting sites Nesting has been reported in the past on Peros Banhos, Salomon, and Diego Garcia (sources cited in Frazier, 1977), and was confirmed more recently on Nelson, an atoll in the Great Chagos Bank, by Frazier (1977). The 1978-79 Joint Services Chagos Research Expedition found signs of nesting on 11 of 17 islands visited on Peros Banhos, and on 11 atolls visited on Salomon Atoll. Of the Peros Banhos nests, nearly one-third were on Ye Ye, and more than half the Salomon nests were on Anglais (Dutton, 1980). Most of the islands comprising the Chagos Archipelago are little visited, and nesting is likely to be more widespread than is currently known (Frazier, 1977).

Nesting numbers On present information, the nesting population is relatively small, probably comprising little more than 300 females (Frazier, 1977). The only direct evidence concerns Nelson Island, in the Great Chagos Bank, where Frazier recorded two dozen nest pits on 25 July 1970. Frazier's informants on Peros Banhos suggested 40-100 turtles could be caught annually, and on Salomon Atoll, only two or three. The 1978-79 Joint Services Chagos Research Expedition found a total of 88 turtle nests on 11 of 17 islands visited on Peros Banhos, and 11 nests on 11 atolls visited on Salomon Atoll (Dutton, 1980). Since all turtles actually seen (apparently at sea) were E. imbricata, the observed nesting may well have been by this species; however, Frazier (1982, citing information from Dutton) states that nests and tracks were large and thought likely to be by C. mydas.

Trends in nesting numbers No reliable information is available.

Nesting season Nesting appears to be concentrated in June-September, during the south-east trades.

Foraging sites No details are available. Foraging grounds, comprising seagrass and algal beds, do not appear to be notably well-developed or widespread in the Archipelago, although several such sites are known (Frazier, 1977).

POPULATION: Eretmochelys imbricata

Nesting sites Although the species has been reported from Peros Banhos and Diego Garcia, and local informants indicated to Frazier (1977) that the species occurs at Salomon and Egmont Atolls, there appears to be very little recent confirmed evidence of E. imbricata nesting. Frazier found one nest on Ile du Coin (Peros Banhos). The past nesting activity recorded in 1978-1979 at Peros Banhos, notably on Ye Ye, and at Salomon, notably on Anglais, may have been by E. imbricata, since all the turtles seen in adjacent waters were this species (Dutton, 1980); however, the signs have been attributed to C. mydas (Dutton, cited in Frazier, 1982).

Nesting numbers Frazier (1977) estimated the annual nesting female population to be 300; this figure is based mainly on annual numbers said to be harvested recently and in the past, not on modern field survey.

Trends in nesting numbers No reliable information is available.

Nesting season Available information suggests that nesting occurs either in July-September and/or in November-February (Frazier 1977).

Foraging sites Coral reef habitats, likely to be utilised by foraging E. imbricata, are widespread in the Archipelago, but no information is available on major feeding grounds.

EXPLOITATION

Commodity The Creoles living in the islands were very partial to turtle meat, eggs and other consumable parts. There was also a significant trade in tortoiseshell (Frazier, 1977).

Hunting intensity Since the last creoles were evacuated from the islands in 1971, it is thought that human predation on turtles has been minimal, and restricted to the occasional passing yachtsman or military personnel (Frazier, 1977).

Hunting methods The local creoles were good seamen and excellent fishermen. A few turtles were caught by harpoon, but the main method was simply turning females on the nesting beaches. There are old records that tied females were used to attract male turtles (Frazier, 1977).

Historical trends Exploitation has probably been carried out on a regular basis for the last century. The estimates of the annual harvests are summarised in Table 27. There is some evidence that the Chagos archipelago has been an important producer of tortoiseshell (Frazier, 1977).

Table 27. Historical data on the estimated annual harvest of C. mydas (C m) and E. imbricata (E i) in British Indian Ocean Territory summarised by Frazier (1977).

	Peros Banos	Salomon	Nelson	Diego Garcia
1786		20 C m (in 4 days)		
1885				60 E i
1905	120 C m 35 E i			
1948	40 C m			
1950s	24 C m			
1970	40-50 C m 50 E i	2-3 C m 20 E i	30-40 C m	
1970	100+ C m 200-300 E i			

Domestic trade Salted turtle meat was said to be available on Diego Garcia in 1970 (Frazier, 1977).

International trade The Chagos Archipelago formerly used to supply both live turtles and oil to Mauritius. Frazier (1977) and Stoddart (1976) compiled import figures from the Mauritius Customs reports, and these are summarised in Table 28. Tortoiseshell was also exported to Mauritius, and from 1904 to 1915, the annual exports averaged 588 kg at 0.057-0.244 kg/US\$. The main source was Diego Garcia (Frazier, 1980a).

The only recent Customs report of an import of tortoiseshell possibly from the Chagos Archipelago was a single import of 68 kg of bekko in 1978 reported in the Japanese statistics as originating in the "Indian Ocean".

The British Indian Ocean Territory is a Dependent Territory of the UK, and is covered under the UK ratification of CITES (2 August 1976). CITES Annual Reports contain no record of trade in turtle products with the Territory.

Table 28. Imports of turtle products from the Chagos Archipelago to Mauritius, compiled from Mauritius Customs reports by Frazier (1977) and Stoddart (1976).

	Live turtles		Turtle oil (1)	
Source:	Peros Banos	Salomon	Peros Banos	Egmont
1905		17		
1906		6		
1910			50	25
1911			22	0
1912			79	0
1913			20	0
1914			17	0
1917	29			
1928	5			
1930	5			
1931	10			
1935	3			

LEGISLATION

All marine turtles have been totally protected since 13 August 1968 (Frazier, 1977).

POPULATION: *Chelonia mydas*

Nesting sites See Table 29. N. Clarke (the Ministry of Natural Resources, *in litt.*, 26 August 1986), however, stated that as far as he knew, there were no records of Green Turtles nesting in the British Virgin Islands.

Nesting numbers Fletemeyer (1984a) estimated the population of nesting females to be 75 ± 25 in 1981.

Trends in nesting numbers No specific information; Fletemeyer (1984a) noted the general belief that the British Virgin Islands sea turtle populations had "declined significantly over the past couple of decades".

Nesting season Nesting reported by Fletemeyer (1984a) occurred June-October.

Foraging sites Foraging occurred around Anegada, Tortola, Virgin Gorda, and Norman's Island (Fletemeyer, 1984). Clarke *in litt.* (26 August 1986) reported a medium abundance of foraging Green Turtles.

POPULATION: *Eretmochelys imbricata*

Nesting sites See Table 29. Clarke (*in litt.*, 26 August 1986) reported low level activity on numerous beaches.

Nesting numbers Clarke (*in litt.*, 26 August 1986) considered nesting Hawksbills to be moderately abundant. Fletemeyer (1984a) estimated the population of nesting females to be 50 ± 25 in 1981.

Trends in nesting numbers Clarke (*in litt.*, 26 August 1986) considered the Hawksbill nesting population to be stable.

Table 29. Nesting sites and observed nesting tracks of Green Turtles and Hawksbills in the British Virgin Islands (Source: Fletemeyer 1984a).

Island	Reported nesting sites	Number of Nesting Tracks observed in July 1981	
		Green Turtle	Hawksbills
Anegada	virtually all round the island	2	10
Beef Is	Long Bay Beach, Little Bay Beach, possibly Bay Beach	3	4
Cooper Is	Manchioneel Beach, Carvel Bay Beach, Markoe Bay Beach Hallowers Beach		-

Table 29 contd.

Island	Reported nesting sites	Number of Nesting Tracks observed in July 1981 Green Turtle	Hawksbills
Camanoe	Cam Bay Beach	3	1?
Great Tobago	possibly at Camp Bay Beach		
Great Thatch Is	possibly at Hollow Beach		
Guana Is	White Bay Beach		
Mosquito Is	North Beach		
Norman Is	Buff Bay Beach		
Peter Is	Deadman Bay Beach		
Jost van Dyke	White Bay, Upper Dog Hole Great Harbour Beach, Garner Bay Beach, East End Beach, Long Bay Beach	3	
Prickly Pear	possibly at Opuntis Pont		
Sandy Spit Sandy Cay	Sandy Spit Beach and Sandy Cay Beach	3	5
Tortola	Hodges Bay, Little Bay, Long Bay, Josia's Bay, Cooten Bay, Trunk Bay, Cooper Bay, Lomer Bay	1	
Virgin Gorda	South-East Beach, St Thomas Bay Beach, Trunk Bay to Tetor Bay Beach, Gorda Sound Beach	2	?1
Necker Island	Devil Bill Bay	2	?1
Scrub Island	North Bay		1

Nesting season Clarke (in litt., 26 August 1986) reported year-round nesting by Hawksbills, with a peak of activity in the winter. Nesting recorded by Fletemeyer (1984a) occurred between June and October.

Foraging sites Fletemeyer (1984a) reported foraging at East End on Tortola, the north-east end of Virgin Gorda, and the east and west coasts of Anegada. Foraging Hawksbills were considered to be of medium abundance by Clarke (in litt., 26 August 1986).

EXPLOITATION

Commodity According to Clarke (in litt., 26 August 1986), the major commodities obtained were meat from Green Turtles and meat and eggs from Hawksbills.

Hunting intensity Fletemeyer (1984a) collected information on the intensity of exploitation. From interviews with fishermen he estimated landings in 1981 of 600 Green Turtles and 300 Hawksbills and similarly estimated incidental catches in the same year of 100 Green Turtles and 100 Hawksbills. Three landing sites were identified, at The Settlement on Anegada and at Fish Bay and East End on Tortola. Fletemeyer also estimated that 12 000 eggs, 25 nesting females and 100 turtles at sea were taken annually for subsistence use. In July 1981 it was further estimated that 50% of the turtle eggs deposited on British Virgin Islands beaches were illegally taken for human consumption.

Hunting methods Turtles were reported to be captured in seine nets and by harpoons (Fletemeyer, 1984).

Historic trends The number of fishermen catching turtles had declined over the years (Fletemeyer, 1984).

Domestic trade Clarke (in litt., 26 August 1986) reported some domestic trade in turtle meat and noted that there was no traditional carving or artifact industry involving sea turtles. Fletemeyer (1984a) noted the price paid for turtles (live weight) at local markets in 1980 and 1981 to be US$0.70 a lb (US$1.54 a kg). It was also estimated that a combined annual income of US$25 000 was earned by the 15 fishermen involved in turtle fishing and that the three people involved in selling items made from turtles earned a combined annual income of US$5000 (Fletemeyer (1984a). Eggs were seldom sold to markets or consumers, according to Fletemeyer (1984a), but were usually redistributed amongst relatives and close friends on the understanding that this would be reciprocated when someone else took a nest.

International trade The British Virgin Islands have been subject to CITES regulations since the UK's ratification on 2 August 1976. CITES annual reports for the period 1977-1985 record imports to the USA of one body of *E. imbricata* in 1982. Clarke (in litt., 26 August 1986) reported some suspected illegal trade with the US Virgin Islands.

LEGISLATION

Turtle Ordinance 1959

The Administrator in Council may set close seasons during which the taking, selling or possession of turtles and their eggs is prohibited. The capture of turtles of less than 20 lb (9 kg) is prohibited at all times.

Turtles (Protection) Notice SR&O 23 of 1959

The close season (defined in the Turtle Ordinance) is set from 1 April to 30 November inclusive, during which period it is illegal to take, buy, sell or possess any turtle, or portion of its meat or its eggs.

Turtles (Protection) Amendment) Notice 15 May 1986

The close season (defined in the Turtle Ordinance) is set from 1 April to 30 November inclusive, during which period it is illegal to take, buy or sell or possess any turtle, or portion of its meat. [The Notice appears not to refer to turtle eggs].

Endangered Animals and Plants Ordinance, 28 May 1986

The import and export of all live or dead animals or plants, specified in Schedule 2, or certain derivatives, specified in Schedule 3, is prohibited except under licence. Schedule 2 includes all seven species of sea turtle.

POPULATION

According to Harrisson (1969), there are no sea turtle nest sites in Brunei. While migrant and, perhaps, foraging sea turtles might be expected to occur off shore, no information is available in this regard.

EXPLOITATION

There is no evidence of local turtle exploitation in Brunei although Malaysian (Sabah) Customs Reports (q.v.) record exports of turtle eggs to Brunei in 1974, 1975 and 1977, indicating that eggs may be consumed in the country. De Silva (_in litt._, 26 August 1988) noted that these eggs originated in the Philippines but were re-exported from Malaysia to Brunei where a higher price (B$0.50-0.75 each) could be obtained. CITES Annual Reports contain no record of trade in turtle products with Brunei.

LEGISLATION

C. mydas, _E. imbricata_ and _D. coriacea_ are protected under the Wildlife Protection Enactment, 11 July 1978. Hunting, killing, capturing, sale, possession or export of these species is prohibited without a licence.

POPULATION: Chelonia mydas

Nesting sites The Green Turtle occurs, with some nesting, along the Arakan and Tenasserim coasts and the western half of the intervening Irrawaddy Delta region, particularly on Thamihla Kyun (Diamond Island) (Salter, 1983). However, according to Maxwell (1911: p. 6) "the green turtle may be said to lay only on Diamond Island as the few thousand eggs deposited by a few stray members of the species on other parts of the coast may be left out of account altogether". Also nests, at least formerly, on Preparis Island and the Cocos group. The following paragraphs are based on information presented by Maxwell (1911) and Salter (1983).

Arakan coast.
Known to nest in the north of the region, on the west coast of Ramree Island, Cheduba Island, at several smaller islands to the south of these two, and at several sites along the Arakan mainland coast, south to Pagoda Point at the western extremity of the Irrawaddy Delta.

Irrawaddy Delta.
Nests primarily on offshore delta islands, notably Thamihla Kyun (Diamond Island), also on Kadonlay Kyun and Gayedgyi Kyun and on certain mainland beaches.

Tenasserim.
Sea turtles are known to nest at a few points along the Tenasserim coast, also the Moscos Islands and the Mergui Archipelago, but little information on the species concerned is available. C. mydas is recorded in the island groups named.

Preparis Island, Cocos Islands.
Large numbers formerly nested on these islands, but no recent data are available. The former is some 100 km south-west of the Delta, the latter 170 km, and adjacent to the Andaman and Nicobar group (India).

Nesting numbers Few details are available. Nesting numbers at most sites appear to be low or very low. The largest turtle bank in Burma, Thamihla Kyun, produces around 200 000 eggs per year, reported to be mostly C. mydas (Salter, 1983). Maxwell (1911: p. 2) stated that this island produced more revenue than all other turtle banks in Burma put together; it seems safe to assume that this implies greater egg production and hence greater turtle nesting than elsewhere in Burma. Assuming that virtually all eggs laid are collected, which appears to be the case (Salter, 1983), and that virtually all are C. mydas, this could represent the output of some 600 females annually (if each lays three clutches of about 100 eggs).

It seems most unlikely, on present information, that total females nesting throughout Burma in a season will exceed 1000 in number, and may well be two to three hundred fewer than this. However, Preparis and Cocos Islands may still support significant nesting; this should be investigated. Maxwell (1911) stated: "Mr Stanley informs me that twenty and more nests may be seen on the Cocos any morning and half that number on Oyster Island during the springs. Maung Po Mya's expedition found large numbers of nests on Preparis." These figures suggest that 200-300 females may have nested in the Cocos group at the turn of the century.

Trends in nesting numbers Available information, while not extensive or detailed, suggests a very marked decline in turtle populations has occurred in the present century. Many sites used by nesting turtles, and leased for

egg collection, now support minimal nesting, or no nesting at all. For example:

a. Offshore islands on the southern Arakan coast between Ngapyawchaung and Pagoda Point: around 47 000 eggs collected annually at the turn of the century (Maxwell, 1911), equivalent to perhaps 140 females nesting in a season, now nesting is "very rare" (source in Salter, 1982).

b. Thamihla Kyun: Complete records are available from the 1885-1886 season (Maxwell, 1911: p. 7). In that season, nestings numbered 19 993, with 2 337,000 eggs collected (virtually all C. mydas according to Maxwell), representing perhaps more than 6500 females. Total annual egg production was relatively steady at around 1 600 000 in the 1890s. representing about 4800 adult females a season (see Table 31). The equivalent figures from the present egg harvest of 200 000 (Salter, 1983) are 1818 nests and 606 females, indicating a decline of around 90% over the past 80 years.

Nesting season On Thamihla Kyun, some nesting occurs all year, but most is between July and November with the peak in October. Nesting is greatest during the monsoon or rains generally (Maxwell, 1911: p. 8).

Foraging sites No precise information, but see next paragraph.

Migration No data are available, but Maxwell (1911: p. 11) stated: "I strongly suspect that the Andaman group is their (primary) habitat and that Diamond Island is only visited for the purpose of depositing their eggs. Notwithstanding the hundreds that lay there, the reptile herself is rarely met with off the coast of Burma". Maxwell envisaged a gradient of abundance, centred on the Andamans (India) and progressively decreasing through the Cocos and Preparis groups, to Diamond Island (Thamihla Kyun).

POPULATION: Eretmochelys imbricata

Nesting sites Nesting is sparse and scattered, (Maxwell, 1911: p. 13), except on a small island in the Bawmi area, Bassein district (Arakan). Salter (1983: p. 46) notes reports from Cheduba Island (north Arakan coast), Irrawaddy Delta islands (including Thamihla, Leikthaung, Kadonlay and Gayedgyi), and the Mergui Archipelago (south Tenasserim).

Nesting numbers "Very rare" (Maxwell, 1911) or "apparently uncommon and of limited distribution (Salter, 1983). On the island in the Bawmi area cited by Maxwell some 10 000 eggs were laid a season, representing perhaps 100 nests and around 30 females, in the early years of this century. No other details available.

Trends in nesting numbers No details available, but has probably shared in the decline of other sea turtles in Burma (a decline of about 90% over the present century in the case of Green Turtles).

Nesting season June-September.

THREATS

The reported near-total harvest of eggs is constituting an acute threat to the population. The fact that the Thamihla Kyun population has declined by

only 90%, to perhaps 600 females a season, despite intense egg collection since at least the 1890s, suggests that harvest may have been significantly less than 100% in some seasons or that some immigration has occurred. Given the evident increased human activity in the Delta, it seems inevitable that the turtle population will decline to complete insignificance in the near future unless appropriate strict controls on egg harvest are immediately imposed.

The threat posed by turtle hunting cannot be assessed in the absence of any information on its intensity. If, as Maxwell (1911) suggested, Green Turtles are quite rarely seen off the Burmese coasts, hunting may not be very significant. In view of the apparent rarity of Hawksbills in the region, exploitation for shell is almost certain to be deleterious.

Some former nest sites (with an uncertain, probably small, proportion of C. mydas and Hawksbills) no longer support nesting owing either to the spread of human settlements or changes in patterns of coastal erosion and deposition (Salter, 1983).

Turtles are fairly commonly caught by artisanal fishermen (in nets or on hooks) and eaten or sold. Commercial prawn trawlers catch appreciable numbers; e.g., 12 turtles in 400 trawls off the Arakan coast (Tarbit, in Salter, 1983: p. 49), or 2-3 in 100 trawls by PPFC trawlers. With 50% mortality this suggests 100 turtles (species composition unknown) killed per season on the Arakan coast. Given the generally small and/or depleted nature of Burmese turtle populations, this is a significant threat.

EXPLOITATION

Commodity The main turtle product exploited in Burma is the eggs of all species, which are collected and marketed on a huge scale. Some subsistence hunting of adults for meat may occur, particularly on Moscos Islands, where nesting C. mydas may be killed. Turtles caught accidentally in trawls or on baited hooks are mostly eaten if they are found dead but may be released if they are still alive (Salter, 1983; Maxwell, 1911). Some E. imbricata are caught for the sale of the shell; mostly from Tenasserim, south of Tavoy, and less from the Arakan coast (Salter, 1983).

Hunting intensity Virtually all the turtle eggs laid in Burma are said to be collected either on an opportunistic basis by fishermen and villagers or on an organised basis by village co-operatives for sale mostly to the People's Pearl and Fishery Corporation (PPFC). The numbers of eggs collected are given in Table 30. At Thamihla Kyun, most of the eggs are of C. mydas, with a few L. olivacea and occasional E. imbricata; from Thekethaung to the Irrawaddy River, they are probably mostly L. olivacea; at Kaingthaung Kyun, mostly L. olivacea with a few E. imbricata; on Kadonlay Kyun and Gayedgyi Kyun, they are probably mostly L. olivacea (misidentified as C. caretta) with a few C. mydas, rarely D. coriacea and E. imbricata; and on South Moscos Island, almost entirely C. mydas. There is a closed season for egg collection on Thamihla Kyun from 1 April to 15 May, which has been in force since 1874, but it has not always been strictly observed, and anyway it is after the main nesting period for C. mydas (Maxwell, 1911; Salter, 1983). On Thamihla Kyun, 5000 to 10 000 eggs a year are collected for artificial incubation and release (Salter, 1983)

Table 30. Marine turtle eggs collected in Burma (Salter, 1983).

	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83
Thamihla Kyun (Diamond Is)	225815	237570	152929	165159	188000	no data
Thekethaung to Irrawaddy R.	no data	94214	19690	22465	52312	no data
Kaingthaung Kyun (Leikthaung)	no data	170000	160000	180000	170000	190000
Kadonlay Kyun	no data	120000	120800	123000	125000	no data
Gayedgyi Kyun	no data	30000	30200	32000	32500	no data
South Moscos	no data	21000	29600	32000	35000	no data

The extent of subsistence hunting for adult turtles is not known, but about 100 turtles a year are thought to be die in trawls operated by PPFC. Most of these are eaten by the fishermen or marketed locally (Salter, 1983).

Hunting methods Eggs are collected by licence holders from nesting beaches the morning after they have been laid. There is some illegal collection by villagers and fishermen (Salter, 1983).

Historical trends Burma is one of the few countries for which there are good historical data for the past levels of exploitation of turtles. Maxwell (1911) described how the collection of turtle eggs was conducted under Government licence in the last half of the 19th century, and compiled statistics for the collection of eggs on Diamond Island from 1883 to 1898. These are given in Table 31, and show that an annual average of 1 744 000 eggs were collected over this period, excluding the incomplete years. There is no direct evidence for the level of exploitation prior to 1883 but Day (1869, cited in Maxwell, 1911) considered that the turtle banks were being exhausted at that time. Maxwell (1911, but writing in 1898) concluded that the level of harvest had remained fairly constant at about two million eggs a year since at least 1870. He cited a fisherman, who had known the bank for "30 odd years", and who informed him that "the take was never more than two millions, and generally about that number". The practice of egg collection was evidently well established at that time as the same fisherman's "father and grandfather before him have had the lease of the [egg collection on Diamond] island".

Maxwell wondered at the apparently undiminished level of the harvest in spite of the fact that the great majority of the eggs were collected every year. Outside the rainy season, virtually every nest was destroyed, but after a night of rain it was estimated that about five nests were missed. At that time there was a closed season for egg collection from 1 April to 15 May, and Maxwell calculated that this period and the number of missed nests allowed a total of 126 000 eggs to escape collection each year, equivalent to a harvest of 93.3% of the mean number laid. This, he surmised, probably rightly, was insufficient to allow the nesting population to replace itself, and concluded that it must be regularly supplemented by immigration from breeding colonies elsewhere in the Bay of Bengal. As a result, he inferred that the protection measures were having no effect and recommended that the closed season should be abolished and that a harvest of

Table 31. The numbers of turtles nesting and the eggs laid at Diamond Island, taken from the records of the lessee of the egg collection rights (Maxwell, 1911). Although it is not stated, it appears that these figures represent the number of eggs collected, rather that the total number laid.

Year	No of turtles	No of eggs
1883-84*	11855	1406330
1884-85*	15780	1850400
1885-86	19993	2337000
1886-87	17926	2104500
1887-88	11859	1389300
1888-89	16703	1930800
1889-90	17199	2011500
1890-91	12077	1431300
1891-92	14143	1671000
1892-93	13699	1621200
1893-94	12847	1509100
1896-97	12808	1511700
1897-98	13797	1668400
Mean for complete years	14823	1744164

* data incomplete, actual production estimated to be over two million eggs

adult turtles should also be taken. Fortunately these recommendations were not adopted, largely on the advice of the Financial Commisioner of Burma, and the closed season was retained. It is ironic that the Deputy Commissioner (Maxwell), arguing on the basis of albeit inadequate biological data, should recommend relaxation of conservation measures, while the Financial Commissioner intuitively held the converse view. History has indicated that Maxwell was correct in his conclusion that the number of eggs spared was insufficient to replace the breeding stock as, by 1980, the number of eggs laid on Diamond Island had fallen by some 90%.

A re-examination of Maxwell's data for the complete years' statistics (1885-1898) shows that the yield appears to have been declining over that period. A regression line, fitted through the logarithmically transformed egg collection data, showed the yield to have declined by 2.37% a year (Correlation coefficient, $r = 0.543$, 9 d.f.). If this rate of decline is extrapolated forwards for the next hundred years, the predicted harvest in 1977 would be 220 701 eggs. The fact that the actual recorded harvest was so close to this value (225 815) is probably fortuitous, but it demonstrates graphically that an apparently constant egg harvest of about 94% a year for 100 years appears to result in a yield declining by an average of 2.4% a year.

The only other nesting site harvested in Burma which is predominantly of C. mydas is South Moscos Island. Mustill (1939, cited in Salter, 1983) recorded that 60 000 eggs were harvested in 1939. The harvest had declined to 21 000 by 1977 (see above), and it is interesting that this represents a very similar rate of population decline, around 2.7% a year.

Domestic trade Most of the eggs collected are taken to coastal towns, where they sell for 30-80 pyas (US$0.04-0.10) each. Some are sold in Rangoon at a retail price of about 1 kyat (US$0.12) each, and some may occasionally be flown to Bangkok (Salter, 1983).

Hawksbill shell is sold to artisans in Rangoon at about US$75-150 per kg. The combs and ornaments made from this are sold locally (Salter, 1983).

International trade The only evidence of external trade in turtle products from Burma is to be found in the Customs reports of imports of unworked tortoiseshell to the Republic of Korea. These record imports of 300 kg in 1975, 1100 kg in 1977 and 500 kg in January-November 1978 (Wells, 1979). There have been no further imports reported from Burma since 1978. CITES Annual Reports contain no record of trade in sea turtle products with Burma.

LEGISLATION

The Fisheries Act. No. III, 1905, amended 1909, 1928, 1934, 1937, 1940 (Salter, 1983).

> All sea turtles come under the provisions of the Act; rights to collect turtle eggs from specified areas can be leased or granted by the Government, collection can also be prohibited in specified areas.

Burma Wild Life Protection Act, 1936. (Salter, 1983).

> Prohibits hunting (wounding, killing, or capturing) any animal in a Wildlife Sanctuary. Dispensation can be granted only for scientific purposes or to preserve the balance of nature. The Forest Department acts as a licensing agency for egg collection in Sanctuaries and Reserved Forests.

Thamihla Kyun and the Moscos Islands (which accommodate virtually the entire Burmese Green Turtle nesting population) are both Wildlife Sanctuaries. A closed season for egg collection, from 1 April to 15 May, has been in force on Thamihla since 1874. According to Salter (1983: p. 50) the spirit of the WLPA (1936) is not followed at either locality since virtually all eggs are collected. The close season is of little use since it does not coincide with the main laying season.

RANCHING

Hatchery or nest protection programmes operate on Thamihla, Kadonlay and Gayedgyi Islands. On Thamihla, 5000-10 000 eggs (perhaps 45-90 nests) are purchased by PPFC, reburied in beach enclosures, and hatchlings raised in sea-water tanks "until large enough for release" (Salter, 1983). The hatching success is reported to be 90-95%, but Salter considered that this was unlikely to be correct.

On Kadonlay and Gayedgyi, towards the end of the nesting season 25 nests are marked and a roofed bamboo enclosure is erected around them after 45 days. Hatchlings are retained in the enclosures for 5-6 days and then released. Survival to release for the 15 500 eggs protected from 1978 to 1982 is reported to have been 55% (Salter, 1983).

CAMEROON

No recent information available; E. imbricata has been recorded at Longji (source cited in Brongersma, 1982), but it is not clear if this is a nesting record. Both C. mydas and E. imbricata seem likely to occur in Cameroon waters.

International trade Cameroon acceded to CITES on 5 June 1981. There is no record of trade in turtle products with Cameroon recorded in CITES Annual Reports.

LEGISLATION

Forests, Wildlife and Fisheries Act, 27 November 1981.

Regulates hunting, possession and trade in wild animals and their products. Regulates fishing and prohibits certain methods. Turtles are not listed as protected species.

There is only one record of *C. mydas* in the Canary Islands (Brongersma, 1982), and one of *E. imbricata* (Brito and Cruz, 1982).

LEGISLATION

The Canary Islands are Spanish Territory, and are included in the EEC. They are also included in the Spanish accession to CITES (30 May 1986).

CAPE VERDE ISLANDS

Brongersma (1982) discussed the literature records that C. mydas once bred in large numbers at the Cape Verde Islands and concluded that records cited by Parsons (1962) of large breeding colonies of sea turtles may have referred to other species. The reported small size of the turtles led Brongersma to suggest that they may have been E. imbricata, which is known to occur in the islands in reasonable numbers, or L. olivacea, which has not yet been recorded. He recommended that further surveys were necessary. Schleich (in litt. to P. Ross, undated) asserted that both C. mydas and E. imbricata bred, and listed Sal, Boa Vista, Maio São Vicente and Branco as breeding sites, saying that nesting occurred in July and August. However it is not certain what his sources of information were, and he may have been quoting Parsons (1962), a source discounted by Brongersma (1982).

EXPLOITATION

Commodity Turtles are captured for meat at Cape Verde and their eggs are collected. The main species captured are C. caretta and E. imbricata (Schleich, 1979). Maigret (1977) reported that there was a tortoiseshell industry for E. imbricata in the islands. Parsons (1962) described how in the 15th century turtle flesh was thought to cure leprosy and syphilis.

Hunting intensity Schleich (1979) reported that about 10-12 turtles a month were landed at Boa Vista and estimated that the annual harvest around the whole archipelago was about 1000 turtles, mostly C. caretta and E. imbricata. The locals were said to search the beaches daily for eggs.

Historical trends Parsons (1962) provided a long account of the early history of turtle exploitation at Cape Verde, stretching back to 1456. However it is now thought that what he called "Green Turtles" may in fact have been other species of sea turtle (Brongersma, 1982).

International trade Schleich (in litt. to P. Ross, undated) mentioned that there used to be a regular export of tortoiseshell to the Netherlands and of carapaces to Belgium.

Cape Verde is not a Party to CITES. CITES Annual Reports record the import from Cape Verde to the Netherlands of 3 Cheloniidae shells in 1984 and of single shells of C. mydas and E. imbricata to the USA in 1980 and 1981.

Japanese Customs Reports indicate that there has been a small import of bekko from Cape Verde since 1976, recording a total of 458 kg of shell in six of the years up until 1983.

POPULATION

The breeding populations of C. mydas and E. imbricata are believed to have been essentially extinct since 1900, and prior to 1980 turtles were only rarely seen in local waters. Nesting by C. caretta and C. mydas still occurs sporadically, and in 1983 a total of 21 nests of both species were located on the islands. These were incubated at Cayman Turtle Farm, and 319 C. mydas hatchlings were released (Anon., 1985f). Hatchling and tagged sub-adult C. mydas bred at Cayman Turtle Farm have been released in coastal waters since 1980 and, recently, tagged turtles have been regularly seen in the sounds and reefs surrounding the islands. The population of juveniles is tentatively estimated to be about 500 (Anon., 1985f).

Foraging populations of C. mydas and E. imbricata occur in the North Sound and on other shelf areas (Parsons, 1984), and juvenile E. imbricata were said to be common in coastal waters (Bacon, 1971), though this may have referred to a 1940 report.

EXPLOITATION

Commodity Green Turtles have historically been a very important source of food in the Cayman Islands. The people of Grand Cayman used to specialise in hunting C. mydas, while E. imbricata was hunted at Cayman Brac, where the inhabitants were said to prefer Hawksbill meat (Parsons, 1962).

Hunting intensity Turtles are theoretically only allowed to be hunted in Cayman Island waters for subsistence use on the islands. The declared landings of turtles are given in Table 32 along with the declared production of Hawksbill shell. There appears to be some discrepancy between the two sets of figures, in that the shell production in 1978 and 1981 indicates a total harvest of around 1000 E. imbricata (assuming 1 kg of shell per animal) instead of the 62 reported.

Table 32. Catches of turtles reported in port landing records, and official statistics for production of E. imbricata shell (Parsons, 1984).

	1977	1978	1979	1980	1981	1982
C. mydas	508	166	521	329	915	170
E. imbricata	94	55	7	0	7	1
" shell (kg)	91	454	0	0	682	0

Hunting methods The traditional methods of turtle hunting employed by the Cayman fishermen were mostly various forms of net. Parsons (1962) described a circular net on an iron hoop which was dropped over sleeping or nesting turtles.

Historical trends Histories of turtle hunting in Cayman Islands have been presented by King (1982) and Parsons (1962). In the early days of Caribbean colonisation, the Cayman Islands were the site of what was probably the largest nesting colony of Green Turtles. Systematic turtle hunting started in the mid-1600s, mainly by ships despatched from Jamaica, and over 13 000 turtles a year were thought to have been extracted by 1688.

Many turtles were turned on the nesting beaches, but some were caught on the feeding grounds to the south of Cuba. By 1711, the first signs of depletion of turtle stocks were recognised, and their extinction was imminent by about 1800. The population of experienced turtle fishermen who then inhabited the islands were forced to sail further afield for their quarry, and fished chiefly around the Miskito Cays of Nicaragua by around 1840. By 1900, the Cayman turtle population was essentially extinct, but 12-17 schooners still fished for turtles into the 1940s, catching about 2000-3000 turtles a year, mostly off Nicaragua. A turtle soup cannery opened in 1952, but closed the following year as it failed to develop the predicted American market. In 1956, the Cayman Islands exported a total of 4109 live C. mydas and 24 000 pounds (10 909 kg) of calipee.

Domestic trade See under RANCHING.

International trade The Cayman Islands, as a dependent territory of the UK, have been included in the UK's ratification of CITES only since July 1979. The major commercial shipments of C. mydas reported to have been exported from the Cayman Islands are shown in Table 33. In almost every case where an export was recorded, the corresponding import reported was smaller. All of the C. mydas products recorded in the Cayman Islands Annual Report are believed to have originated in the turtle farm. There is a very good correlation between the quantities in Table 33 and the exports reported by the farm in Table 38 for the years 1980-1983. A variety of other countries have been reported as the destination of C. mydas products exported from the Cayman Islands, and these are shown in the first half of Table 34. Exports reached a peak in 1979 and 1980, in terms of volume, and were sent to the greatest variety of countries in 1980. This corresponds to the period at which Cayman Turtle Farm was forced to slaughter and sell off most of its stock (see below).

Many products said to have originated in the Cayman Islands have been recorded in CITES Annual Reports as re-exports, and the countries to which these re-exports have been sent are shown in Table 34. The number of destination countries reached a peak in 1982 and 1983, and this probably represents a time delay of two years between the primary export and the re-export of manufactured products. The countries reported to have re-exported Cayman Island turtle products are shown in Table 35, the main ones being F.R. Germany, the UK, Italy and Switzerland. Attention should be drawn to the re-exports of large quantities of turtle skins from Mexico reported on import into Hong Kong in 1981, 1982 and 1983. There is no indication that the Cayman Islands ever exported any turtle skins to Mexico and so it seems most probable that the skins were of wild origin, having had a false origin declared on the export documents.

Japanese Customs statistics recorded few imports of bekko from the Cayman Islands prior to 1972, but imports since that date have been substantial (Table 36). Port landing statistics clearly indicate some landings of E. imbricata in the Caymans (Table 32), but the quantities seem too low to account for the volume of imports to Japan. A possible explanation is that the exports were from other ports in the Caribbean but despatched by a Cayman Islands company (Luxmoore and Canin, 1985). The imports of other tortoiseshell and turtle skins reported between 1980 and 1984 seem comparable with the quantities of shell and skin reported as having been exported by the Cayman Islands (Table 33).

Table 33. Direct exports of commercial shipments of products of <u>C. mydas</u> from Cayman Islands recorded in CITES Annual Reports. All values are in kg, except for skins, which were recorded as sets unless otherwise specified. Figures in brackets indicate reports submitted only by the importer.

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
MEAT + CALIPEE										
Bahamas	0	0	0	14	0	0	0	0	0	0
Bahrain	0	0	0	1364	0	0	0	0	0	0
Canada	0	0	0	59	0	0	0	0	0	0
FRG	(31819)	(2370)	(34351)	179006	64040	0	7386	0	0	0
Japan	0	0	0	0	11	0	0	0	0	0
S. Africa	0	0	0	1864	0	0	0	0	0	0
Switzerland	0	0	0	295	0	0	0	0	0	0
UK	(907)	0	(17578)	3182	(10364)	0	7455	(5902)	0	0
USA	0	0	(16936)	0	0	0	0	0	0	0
Total	32726	2370	68865	185784	74415	0	14841	5902	0	0
SHELL + SCALE										
Canada	0	0	0	1	0	0	0	0	0	0
France	0	0	0	1	0	0	0	0	0	0
FRG	0	0	0	4003	3054	0	205	0	0	0
Haiti	0	0	0	8045	0	0	0	0	0	0
Japan	0	0	0	2046	435	1945	55	55	95	195
Spain	0	0	0	0	0	0	0	0	1	0
UK	(14)	(5)	0	0	182	1	1	1	2	3
USA	0	(57)	0	0	0	0	0	0	0	0
Total	14	62	0	14456	3671	1946	261	56	98	198
OIL										
Canada	0	0	0	4	0	0	0	0	0	0
France	0	0	0	595	364	182	0	0	0	0
Italy	0	0	0	0	0	0	0	1080	0	1091
Japan	0	0	0	742	727	2964	729	364	1271	2000
Korea	0	0	0	0	0	0	1	0	0	0
Mexico	0	0	0	0	0	0	170	0	0	0
Taiwan	0	0	0	0	0	0	0	0	17	0
UK	0	0	0	750	182	545	727	545	0	182
USA	0	0	(248)	0	0	0	0	0	0	0
Venezuela	0	0	0	10	0	0	0	0	0	0
Total	0	0	248	2951	1273	3691	1627	1989	1288	3273
SKINS										
France	0	0	0	2	0	0	0	0	0	0
FRG	0	(2603)	0	0	0	0	0	0	0	0
Italy	0	0	0	3100	2709	0	0	0	0	0
Japan	0	0	0	7000	650	0	0	0	0	0
S. Africa	0	0	0	0	0	4	0	0	0	0
UK	0	0	(7727 kg)	0	0	0	0	20	0	0
Total	0	2603	7727 kg	10102	3359	4	0	20	0	0

Table 34. Countries recorded in CITES Annual Reports to have received C. mydas exports from and re-exports originating in the Cayman Islands. Brackets indicate report only submitted by the importer.

EXPORTS

1977	(DE), (GB)
1978	(DE), (GB), (US)
1979	(CA), (DE), (GB), (US)
1980	AN, AU, BE, BH, BM, BS, CA, CH, DE, DK, ES, FR, GB, GT, HT, IT, JP, PC, US, VE, ZA
1981	BE, BM, BS, CA, (CH), DE, FR, GB, IT, JP, SE
1982	AU, BE, FR, GB, JM, JP, MX, ZA
1983	CU, DE, FR, GB, JP, KR, MX, US
1984	GB, IT, JP, US
1985	CA, ES, FR, GB, HK, IE, JP, TW, US
1986	CH, DK, GB, IT, JP, US

RE-EXPORTS

1977	CH
1978	AU, CH, DK, FR, GB
1979	CA, CH, DE, DK, FR, GB, HK, HT, IT, JP, MX, NL, SG
1980	BE, CH, DE, DK, FR, IT, JP, NL, ZA
1981	AT, CA, CH, DD, DE, DK, ES, FR, GB, HK, JP
1982	AT, BE, BM, CH, DE, DD, DK, ES, FI, FR, GB, HK, IE, JP, NL, NO, OM, SE
1983	AT, BE, CH, DE, DD, DK, ES, FR, GB, HK, IE, IT, JP, NL, SA, SG, US, ZA
1984	AT, CH, CS, DD, ES, HK, HU, JP, KR, NO, NZ, PT, SG, TR, ZA
1985	AT, AU, BB, CH, CS, DD, HK, JP, KW, NO, PT, ZA

AN Netherlands Antilles, AT Austria, AU Australia, BB Barbados, BE Belgium, BH Bahrain, BM Bermuda, BS Bahamas, CA Canada, CH Switzerland, CS Czechoslovakia, CU Cuba, DE F.R. Germany, DD D.R. Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GT Guatemala, HK Hong Kong, HT Haiti, HU Hungary, IE Ireland, JM Jamaica, JP Japan, KR South Korea, KW Kuwait, MX Mexico, NL Netherlands, NO Norway, NZ New Zealand, OM Oman, PC Pacific Islands, PT Portugal, SA Saudi Arabia, SE Sweden, SG Singapore, TR Turkey, TW Taiwan, US USA, VE Venezuela, ZA South Africa

Table 35. Countries recorded in CITES Annual Reports to have re-exported C. mydas products which originated in the Cayman Islands. Brackets indicate report only submitted by the importer. For key to country codes, see Table 34.

1977	DE
1978	DE, GB
1979	DE, GB, (MX), US
1980	DE, GB, NI
1981	CH, DE, (IT), (JM), (MX)
1982	CH, DE, GB, (HT), (IT), (JP), (MX)
1983	CH, DE, FR, GB, IT, (MX), (NL)
1984	CH, DE, GB, IT, NL
1985	CH, DE, FR, GB, IT

Table 36. Imports of bekko, other tortoiseshell and turtle skins from the Cayman Islands reported in Japanese Customs statistics (kg). No imports were reported in 1985 or 1986.

	1972	'73	'74	'75	'76	'77	'78	'79	'80	'81	'82	'83	'84
Bekko	78	936	963	1083	3096	3863	6321	6110	2505	3022	2258	0	115
Other	2950	2150	1410	405	1851	1331	240	569	405	600	1210	250	168
Skins	-	-	-	-	-	36	23514	2824	14778	6687	0	0	0

RANCHING/FARMING

There is one turtle farm on Cayman Islands, currently trading under the name of Cayman Turtle Farm (1983) Ltd, P.O. Box No. 645, Grand Cayman (General Manager: Dr J.R. Wood). A farm was first established in 1964 at Governor's Creek, North Sound, Grand Cayman, and then operated as a company called Mariculture Ltd from 1968 until 1975, when it was liquidated owing to financial problems. The farm was bought in 1976 by new investors including a German couple, the Mittags, and set up as Cayman Turtle Farm. At the same time the operation was moved to a land-based site at Goat Rock. In March 1983, after again going into receivership, it was bought and taken over by the Government of the Cayman Islands.

At the 4th Meeting of the Conference of the Parties to CITES a proposal was presented by the UK which would allow limited trade in captive bred specimens of species which took longer than three years to reach maturity. The argument was that it was unreasonable to expect a commercial enterprise to wait until the requirements of Conf. 2.12 with respect to the breeding to second generation had been fulfilled for long-maturing species because that might entail waiting for 30 or more years before commercial sales could take place. The proposal was discussed in the Technical Export Committee session but strong opposition was expressed on the grounds that Conf. 2.12 had been adequately drafted. As a result the proposal was withdrawn before being presented to the Plenary session and was referred back to the TEC. A proposal was then presented to the 5th Meeting of the Conference of the Parties to consider the turtle population of the Cayman Turtle Farm as a ranched population, and to transfer it to Appendix II under the terms of Resolution Conf. 3.15. This was rejected on the grounds that Conf. 3.15 should only apply to wild populations. The UK Government then submitted a special resolution to allow trade in turtle products from CTF, but this was also rejected.

Stock On 1 January 1984, a total of 17 134 C. mydas were kept on the farm, including 283 breeding stock. The farm also maintains a herd of 43 Lepidochelys kempii owned by the Mexican Government under a joint conservation project.

Production The products of the farm are meat, shells, oil, leather, calipee and calipash. Animals are slaughtered at about 3.5 years at an average weight of 24 kg. In 1982 annual production goal was 1500 turtles. Approximate production figures are given in Table 37.

Following the decision of the USA, in 1979, to ban the importation of all sea turtle products including farmed products, Cayman Turtle Farm reduced its total stock from 2 000 000 lb (909 091 kg) live weight in 1978 to 200 000 lb (90 909 kg live weight in 1983. Intense destocking from 1979 to

Table 37. Approximate production figures from Cayman Turtle Farm for 1980-1982 (J.R. Wood <u>in litt.</u>, 16 June 1983).

Commodity	Units	1980	1981	1982
Turtles slaughtered		32 123	4 621	858
Total weight	kg	599 770	90 342	50 511
Meat	kg	137 727	20 455	11 818
Calipee/Calipash	kg	36 364	5 455	3 045
Shell (Carapace)	kg	5 455	818	455
Shell (Plastron)	kg	1 818	273	136
Skins	sets	15 000	800	300

1981 meant killing 47 270 animals with a production of 204.5 t of meat over three years (J.R. Wood <u>in litt.</u> to A. Mason, 15 March 1982). This is reflected in the large number processed in 1980. In addition, over 800 farm-reared animals set aside for breeding were slaughtered between 1980 and 1982. No animals obtained from the wild as adults have been processed (J.R. Wood <u>in litt.</u>, 16 June 1983).

Trade Trade is mainly to Japan, UK, West Germany, Italy and France (J.R. Wood <u>in litt.</u> to A. Mason, 15 March 1982). There is also a growing sale of turtle products to tourists from the farm shop. All products are clearly marked with the CTF logo (J.R. Wood <u>in litt.</u> to J. Barber, 30 October 1980). The shell is reported to be biochemically distinguishable from wild shell (Hendrickson <u>et al.</u>, 1981).

Table 38. Exports from Cayman Turtle Farm (Anon., 1985f).

Product (units)	1977	1978	1979	1980	1981	1982	1983
Meat (kg)	99 386	20 716	57 117	89 715	11	0	0
Soup products (kg)	73 127	6 575	60 570	96 295	64 040	0	8 386
Oil (kg)	1 009	984	1 094	2 051	1 272	3 690	1 625
Skin (sets)	24 472	6 501	7 516	10 102	3 359	4	520
Jewellery (pieces)	57 629	53 164	56 832	11 432	0	16	0
Scutes (kg)	225	273	1 128	12 409	3 227	1	219
Belly shell (kg)	682	1 182	4 282	2 045	435	125	55
Hooves (kg)	0	0	0	0	9	1 820	0
Polished shells	307	50	393	68	1 311	138	27
Freeze-dried or stuffed turtles	254	109	4	74	1	0	0

Source of stock The original stock came mostly from eggs taken from the wild and hatched on the farm (Wood and Wood, 1981). Most of the eggs came from Suriname but some were from Ascension Island and Costa Rica (E.C. Roet <u>in litt.</u> to R. Parsons, 17 February 1983). The numbers of eggs removed annually from the wild are given in Table 39. No wild eggs have been obtained since 1978.

Some adult animals were also taken from the wild to act as broodstock; these came from Suriname, Ascension, Costa Rica, Guyana, Nicaragua and Mexico

(E.C. Roet in litt. to R. Parsons, 17 February 1983). The last import of adults was from Mexico in September 1977 (J.R. Wood in litt., 16 June 1983). The total number of adult turtles obtained is estimated to be around 250 (Mrosovsky, 1983).

Breeding The wild-collected eggs have been incubated on the farm, and the hatching success experienced is shown in Table 39. The first hatchlings obtained from eggs laid on the farm (by parental breeding stock collected from the wild) took place in 1973. Since then, successful breeding has occurred regularly; the numbers of eggs laid and their hatching success rate is also shown in Table 39. The first successful hatching of eggs obtained from adults which themselves had been hatched on the farm occurred in 1975, and the numbers of eggs produced, together with their hatching success rate, are shown separately in Table 39. It can be seen that the hatching success has been considerably lower for eggs from the farm-reared stock than from the captive-wild stock, which, in turn, was lower than from the wild-collected eggs. The low success has been attributed to diminished fertility, the causes of which are still being investigated, but are thought to be related to the greater obesity of farm-reared animals and the shorter time spent in coition (Anon., 1985f).

There has been no second-generation breeding of turtles on the farm. Turtles conceived and hatched on the farm have only recently reached maturity. The first two such females laid eggs in 1983 and a further two broods were laid in 1984, but none of the eggs has hatched (Ford, 1985).

Table 39. Hatching results of eggs incubated at Cayman Turtle Farm, obtained from different sources: 1. Wild-collected eggs, purchased by the farm; 2. Eggs laid by turtles in the farm which had been collected from the wild as adults (Captive-wild); 3. Eggs laid by turtles in the farm which had themselves been hatched from eggs on the farm (Farm-reared). Data from Anon. (1985f) and E.C. Roet (in litt. to R. Parsons, 17 February 1983). Hatching successes in brackets are for only part of the total eggs laid.

Year	1 Wild-collected		2 Captive-wild		3 Farm-reared	
	Eggs set	% hatching	Eggs set	% hatching	Eggs set	% hatching
1968	15000	?	0		0	
1969	30000	(52)	0		0	
1970	54946	(75)	0		0	
1971	30000	48	0		0	
1972	61256	61	0		0	
1973	97312	78	11376	43	0	
1974	80464	76	9634	45	0	
1975	0		16827	20	600	33
1976	42380	61	14569	36	617	8
1977	21000	61	32569	60	739	3
1978	28173	76	29672	50	4293	27
1979	0		38058	31	8462	7
1980	0		34738	27	8861	7
1981	0		24900	20	8928	0
1982	0		40304	22	13212	1
1983	0		61225	33	9271	6
1984	0		28538	26	11785	6

Husbandry Until 1975, the farm was situated in an inlet but the tidal flushing was inadequate and it was moved to a series of land-based concrete and fibre-glass tanks (E.C. Roet, in litt. to R. Parsons, 17 February 1983). The broodstock animals are kept in two ponds 0.167 and 0.192 ha in area with maximum depths of 1.98 m and 2.8 m; each has a breeding beach at one end (Wood and Wood, 1981). Animals reared together tend not to mate until new stock is introduced; so to stimulate mating, the males are separated from the females in December-January and re-introduced in March-April (Wood and Wood, 1981). Animals being reared are held in concrete tanks ranging from 2 m by 3 m up to 21 m in diameter (J.R. Wood, in litt., 16 June 1983). All animals are fed on a commercially prepared pelleted ration.

Finances Neither CTF nor its predecessors has made a profit in any year of operation (Anon., 1985f). The finances of the farm were severely hit in 1979 when the USA, previously the main importer, banned imports from the farm. This caused them to reduce planned production from 12 000 turtles a year to 1500 and the labour force was reduced from 92 to 24 (J.R. Wood, in litt. to A. Mason, 15 March 1982). The farm has a growing tourist income from visitors to the farm, and derives the remainder of its income from sales of meat and other products within the Cayman Islands. It is estimated that there is a local market for an annual production from 3000 turtles, but that the farm would not be profitable at that level of production without more lucrative export markets (Ford, 1985). The target production for profitability would be 5000 turtles a year, which would produce an income of US$800 000 from the sale of products and US$500 000 from tourists, giving a profit of US$200 000.

Releases Between 1969 and 1977, turtles varying in age from 10 to 36 months were released at sites from which the eggs had been obtained: 600 were released at Costa Rica, 208 at Ascension, 880 at Suriname and 24 on Grand Cayman. Since 1980, all the hatchlings have derived from turtles of mixed origin breeding on the farm, and turtles have only been released around the Cayman Islands, a total of 9448 having been released up to the end of 1984 (Anon., 1985e).

LEGISLATION

Endangered Species Protection & Propagation Law 1978. (Repeals the Turtle Protection Law of 1969)

The import and export of live or dead species on the schedule is prohibited without a licence from the Governor (includes parts and derivatives).

This does not include the bringing into the Islands of turtles taken within the fishery limits of the Islands, if taking such turtles is customary and traditional, and the turtles are intended only for consumption by people within the Islands.

Import and export of shell and scales, unworked or simply prepared (but not if cut to shape), the waste of the shell and scales and the claws of all Cheloniidae is restricted.

Schedule - Part 1	E. imbricata imbricata
	L. kempii
Schedule - Part 2	C. caretta
	C. mydas
	C. depressa
	E. imbricata bissa
	L. olivacea

The Marine Conservation (Turtle Protection) Regulations 19 September 1978.

The trade in products of all marine turtles and hybrids between marine turtle species is regulated.

The possession of any turtle egg is prohibited, unless it is from a turtle bred in captivity, or the holder has a licence.

It is prohibited to take, disturb or molest in any way, a female turtle during the months May to September inclusive.

CHILE

C. mydas is the most common species of sea turtle in Chilean waters, and is said to be found most often in the summer. The record from Isla Desolacion (52°57'S) is the most southerly in the world. There are no confirmed records of breeding, but there are various reports of finding small turtles on beaches in Cipani, Iquique and Chiloe. E. imbricata has never been recorded (Frazier and Salas, 1983).

EXPLOITATION

Turtles are captured sporadically in Chile, but there is said to be no market for the products, and fishermen consider it bad luck to kill them. They are evidently not an important resource (Frazier and Salas, 1983).

International trade

Chile ratified CITES on 14 February 1975. CITES Annual Reports record no trade in turtle products with Chile other than a single shipment of 3 lb of eggs of C. mydas imported to the USA in 1981.

LEGISLATION

Apart from its obligations under CITES, Chile does not regulate hunting or trade of reptiles.

CHILE: EASTER ISLAND

Most information about turtles on Easter Island comes from Harrisson (1971, cited in Pritchard, 1982a). Apparently four species, including C. mydas and E. imbricata occur there and are well known to the natives, though they were said to be more scarce and irregular than they were last century. Nesting may occur on sheltered beaches. The ancient inhabitants built stone "turtle towers" along the coastline, but they have not been used in living memory. There are indications that the turtles were respected and not slaughtered indiscriminately, though these traditions were lost with the coming of Catholicism.

A National Park management plan (Anon., 1976) said that the island was occasionally visited by C. mydas agassizi, C. japonica (= C. mydas mydas) and E. imbricata. No breeding has been reported.

POPULATION: Chelonia mydas

Nesting sites The species occurs widely through the South China Seas, and has been recorded in waters off the Chinese mainland from Shandong Province south and west to Guangdong Province, also Hainan Island and the Dongsha, Xisha and Nansha island groups. Nesting, however, appears to be largely restricted to the islands, and only the Xisha (Paracel) Islands are at present known to hold significant numbers (Huang Chu-Chien, 1982; Frazier and Frazier, 1985). Nesting is sporadic and of little significance on Hainan and on the mainland (Frazier and Frazier, 1985) with the exception of Huidong County (where the nesting beach was declared a Nature Reserve in 1984). Some nesting also occurs in Huiyang and Haifeng Counties. All known mainland and island nest sites are within Guangdong Province (Wang Xiaoyan in litt., 20 November 1986).

Nesting numbers The only detailed information on nesting numbers, see Table 40, concerns the protected turtle beach in Huidong County.

Table 40. Nesting data from Huidong Nature Reserve (Wang Xiaoyan in litt., 20 November 1986) (n.b. it seems possible that data in columns two and three have been transposed; as given, hatching success would have been over 90%, whereas the 55-60% rate indicated if the figures were transposed would be closer to the mean value for several C. mydas sites).

Year	Nesting females	Nests	Hatchlings
1985	87	47	3933
1986	122	78	7490

Elsewhere on the mainland, possibly around a dozen C. mydas nest between Fujian and Hainan Island; very few, if any, appear to nest on Hainan itself (Frazier and Frazier, 1985), but numbers nesting in the Xisha group are suspected to be large (Frazier and Frazier, 1985, Huang Chu-Chien, 1982). Turtle fishery data (Table 41) indicate that a few hundred turtles (not exlusively C. mydas, but probably mainly this species) have been caught annually in the Xisha region over the past two decades, suggesting that annual nesting numbers here may be in the low hundreds. There is no information on numbers in the Dongsha and Nansha Islands. Nesting and foraging habitat appears to be widespread in the Nansha Islands and the group may be suspected to hold significant nesting numbers.

Trends in nesting numbers Although no comparative data are available, Wang Xiaoyan (in litt., 20 November 1986) and Frazier and Frazier (1985) state that turtle numbers have declined; the latter authors cite numerous instances where local informants reported that significant nesting once occurred but now there is none. Decline is attributed (Frazier and Frazier, 1985) to over-fishing and habitat loss.

Nesting season Most C. mydas nesting in the Xisha Islands occurs in May-July (Huan Chu-Chien, 1982).

Foraging sites The South China Seas islands, including the Xisha, Nansha and Dongsha groups, and to some extent Hainan, appear to provide suitable foraging grounds, but no information is available on important sites.

Migration According to Huang Chu-Chien (1982), sea turtles (which may be presumed to be mainly C. mydas) occur throughout the year in the Nansha and Xisha groups, but include both a resident component and a migratory component, which arrives in April with the prevailing warm southwest currents. This migratory population may forage around the southern margins of the South China Sea, possibly in Indonesia, but confirmatory data are lacking.

POPULATION: Eretmochelys imbricata

Nesting sites Little information is available. The species appears to be widely recorded in Chinese waters in the same areas as C. mydas, namely, the mainland coast from Shandong south-west to Hainan and the islands of the South China Sea; records also exist for the East China Sea (Huang Chu-Chien, 1982). It is uncertain to what extent nesting occurs in China; in general, turtle nesting is largely restricted to the Nansha and Xisha Islands in the South China Sea, and although E. imbricata nesting seems possible here, only C. mydas nesting appears to be confirmed (Huang Chu-Chien, 1982; Frazier and Frazier, 1985). According to Frazier and Frazier, only C. mydas breeds in China.

Trends in nesting numbers No good information available; according to Wang Xiaoyan (in litt., 20 November 1986) and Frazier and Frazier (1985), sea turtle nesting in general has declined in recent decades.

Foraging sites No information available, but the Nansha and Xisha island groups appear to provide extensive suitable feeding grounds.

Migration No information. Sea turtles are most numerous in summer along the mainland and around Hainan (Frazier and Frazier, 1985), suggesting that populations tend to be migratory.

EXPLOITATION

Commodity Formerly the main use of turtles was for meat and many of the other parts were thrown away. There is now a market for most parts of turtles, and even the shell can be sold to make wine (Frazier and Frazier, 1985). E. imbricata shell has traditionally been used for the fashioning of spectacle frames, necklaces and other ornaments, and the shell of C. mydas is used in traditional medicine (Wang Xiaoyan in litt., 20 November 1986).

Hunting intensity Frazier and Frazier (1985) estimated that the incidental catch of turtles in Fujian and Guangdong might approach 1000 a year and could account for a very high percentage of the turtles nesting. Harvest statistics have not been kept recently in the Xisha Islands, although the intensity is believed to be high. The total quantity of turtles landed in Qionghai County, Hainan amounted to 97 t in 1985 (Table 41). Fishermen from Quionghai county had captured 2034 turtles in the Xisha and Dongsha Islands until the end of 1986 (Huang Chu-Chien in litt., 13 August 1988).

Hunting methods Turtles are caught on the nesting beaches, deliberately at sea in trammel nets or with harpoons, and accidentally during the course of other fishing operations. Accidental capture is probably the most significant form of mortality in Fujian and Guangdong on the mainland. The only places where turtles are deliberately caught at sea are Hainan and the Xisha Islands (Frazier and Frazier, 1985).

Historical trends Previously, turtles were revered by fishermen and were released when they were caught accidentally. However their increasing rarity means that virtually every turtle caught is now killed (Frazier and Frazier, 1985).

Turtle fishery statistics are available for the Xisha Islands from 1959 to 1977 and for Hainan from 1977 to 1985 (Table 41). The early statistics from the Xisha Islands relate to the landings at Yong Xing purchasing station (Huang Chu-Chien, 1982). It is not known how these relate to the later statistics from the Xisha Islands (Wang Xiaoyan _in litt._, 20 November 1986) which appear to have been higher in 1970. The fishery in the Xisha Islands shows no clear trends, but the catches in Hainan seem to have been increasing.

Table 41. Turtle fishery statistics for the Xisha Islands and Hainan in tonnes. The first column relates to the landings at Yong Xing purchasing station, Xisha Islands (Huang Chu-Chien, 1982). The last two columns were given as the fishery statistics for the Xisha Islands and Qionghai County, Hainan (Wang Xiaoyan _in litt._, 20 November 1986).

Year	Xisha	Xisha	Hainan
1959	130.6		
1960	40.6		
1961	54.0		
1962	38.7		
1963	103.0		
1964	61.1		
1965	181.3		
1966	86.9		
1967	149.9		
1968	43.0		
1969	104.8		
1970	122.6	135.1	
1971		38.8	
1972		120.5	
1973		118.4	
1974		90.9	
1975		34.6	
1976		115.6	
1977		34.0	28.0
1978			32.0
1979			41.0
1980			33.0
1981			37.0
1982			42.5
1983			55.0
1984			65.0
1985			97.5

Domestic trade Turtles are said to sell for the equivalent of a month's wages (Frazier and Frazier, 1985).

International trade Overseas trade statistics are not available for China, but it is possible to infer imports and exports of tortoiseshell from the export and import statistics of its trading partners. These are given in Table 42. The only countries to report exports to China were Hong Kong, Singapore and Thailand, while Hong Kong and Japan reported importing from China. Japan's imports were recorded under the category of "tortoiseshell excluding bekko", implying that they were not E. imbricata shell. It is not known how much if any of the remaining trade represents the shell of sea turtles, but it is probable that most was the shell of freshwater turtles, because most of Hong Kong's and Thailand's exports are thought to be of this commodity.

China acceded to CITES on 8 January 1981, and has never recorded any trade in sea turtle products in its Annual Reports. The USA has recorded seizing small quantities of various turtle products said to have originated in China, and Italy reported exporting six C. mydas handbags to China in 1983.

Table 42. Imports and exports of tortoiseshell (kg) to and from China inferred from the Customs export statistics of Hong Kong, Singapore and Thailand and the Customs import statistics of Hong Kong, Japan and South Korea.

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
IMPORTS												
Hong Kong	4257	5221	3902	2781	3827	300	–	8196	7062	15489	19288	76956
Singapore	–	–	–	600	–	–	600	538	4743			
Thailand	–	–	–	–	–	–	–	–	2650	8100	–	–
EXPORTS												
Hong Kong	–	–	–	–	–	–	–	–	–	–	600	216
Japan	1410	405	1851	1331	240	569	405	600	1210	250	168	
S. Korea	–	–	600	–	–	–	–	1000	–	3500	500	–

LEGISLATION

Wang Xiaoyan (in litt., 20 November 1986) listed four pieces of legislation protecting sea turtles in China:

(1) Regulation of breeding and protection of aquatic resources.
(2) Detailed rules and regulations of aquatic resources reproduction and protection in Guangdong Province
(3) Stipulation of the reserves of Xisha, Nansh and Zhongsha Islands in Guangdong.
(4) Stipulation of the Huidong Turtle Reserve, Guangdong Province.

COLOMBIA: CARIBBEAN

POPULATION: Chelonia mydas

Nesting sites Beach habitat suitable for turtle nesting is extensive, but confirmed C. mydas nesting is very sparse; the species occasionally nests on the mainland between Cartagena and Santa Marta, very occasionally in the Islas del Rosario (Carr et al., 1982), and possibly among other island groups. Turtle nesting, possibly involving some C. mydas, is said to occur around the Guajira Peninsula and in the San Andres Archipelago (Mast, 1986), although Kaufman (1971) considered the former to be unsuitable for turtle nesting.

Nesting numbers Very little numerical information is available. According to Kaufman, (1971), nesting by this species had become "only occasional" (beaches west of Santa Marta not investigated). Ogren (1984) reported two and three confirmed C. mydas nests (tracks) in two aerial surveys of large portions of the Caribbean coast of Colombia conducted in 1983. On present evidence, C. mydas nesting in Caribbean Colombia is of little significance. The species is said to be less frequently encountered in Colombian waters than E. imbricata or Caretta caretta (Carr et al., 1982).

Trends in nesting numbers While nesting around 1970 was occasional, 15-20 years previously (i.e. 1950-1955) both C. mydas and E. imbricata used to nest frequently; 10-12 females nightly on the 7.5 km Buritaca-Don Diego beach (Kaufman, 1971). Mast (1986) reports that artisanal fisheries have been faced with declining numbers of turtles, although it is not clear to what extent numbers nesting in Colombia have declined, rather than foraging turtles that nest on distant beaches. Carr et al., (1982) state that Colombian sea turtle populations are generally depleted, due to heavy exploitation.

Nesting season According to Mast (1986), C. mydas nests mainly in May-July, sometimes extending into August.

Foraging sites Some seagrass pastures, suitable for C. mydas, exist around the Islas del Rosario, and possibly other islands, but this habitat is extensively developed around the Guajira Peninsula (Carr et al., 1982). Many of the 58 turtles tagged at Tortuguero (Costa Rica) and recovered in Colombian waters were captured around the Guajira Peninsula (Carr et al., 1982).

Migration No information is available on long-distance movements of C. mydas nesting in Colombia; as noted above, feeding grounds in Colombia are utilised by turtles nesting elsewhere, specifically at Tortuguero.

POPULATION: Eretmochelys imbricata

Nesting sites The species nests in the Islas del Rosario, reportedly in the San Bernado Islands, occasionally on the mainland between Cartagena and Santa Marta (Carr et al., 1982; Mast, 1986). In the Gulfo de Uraba, there are two nesting beaches near Acandi (Ramos Mora, 1987). Ogren (1984) cited unconfirmed reports of nesting at Playa Blanca and Isla Baru. Data from 1965 indicated that E. imbricata nested in South West Bay, Isla de San Andres (Chirivi Gallego, 1978).

COLOMBIA

Nesting numbers No numerical information is available. According to Kaufman, (1971), nesting by this species had become "only occasional" (beaches west of Santa Marta not investigated). Only small numbers nest in the Islas del Rosario. Ramos Mora (1987) reported that 11 E. imbricata nested on the beach near Acandi during four nights of observation in 1987. On present evidence, nesting by E. imbricata on the Caribbean coast of Colombia is very sparse.

Trends in nesting numbers While nesting around 1970 was occasional, 15-20 years previously (i.e. 1950-1955) both C. mydas and E. imbricata used to nest frequently; 10-12 females nightly on the 7.5 km Buritaca-Don Diego beach (Kaufman, 1971). According to Kaufman (1975, cited by Pritchard and Trebbau, 1984) E. imbricata has been virtually exterminated from mainland Colombia as a nesting species. Mast (1986) reports that artisanal fisheries have been faced with declining numbers of turtles, although it is not clear to what extent numbers nesting in Colombia have declined. Carr et al. (1982) stated that Colombian sea turtles were generally depleted, as a result of heavy exploitation.

Nesting season Most nesting is thought to occur in May-July, sometimes into August (Mast, 1986).

Foraging sites Extensive coral reef habitat is available around the Islas del Rosario, reportedly excellent for E. imbricata; good foraging grounds also exist around the San Bernado Islands (Carr et al., 1982; Ogren 1984).

THREATS

The apparent decline in turtle numbers is attributed to exploitation, and incidental catch by shrimp trawlers (Carr et al., 1982; Mast, 1986). Kaufman (1971) reported that all nesting turtles and all females are taken whenever found. Habitat destruction is a problem in some areas: on Providencia, sand mining has completely destroyed one previous nesting beach; and tourist development has ruined beaches in San Andres, Cartagena and on the mainland between Barranquila and Santa Marta. Military personnel stationed on San Andres are said to shoot nesting turtles for sport (Mast, 1986).

COLOMBIA: PACIFIC COAST

Very little information is available on sea turtles on Colombia's Pacific coast. Green and Ortiz-Crespo (1982) cited information from contacts in Colombia (H. von Prahl, F. Guhl) that both C. mydas and E. imbricata have been recorded in the region; both are harvested, for food and tortoiseshell respectively; no information was available on nesting. The only record of C. mydas in Pacific Colombia available to Green and Ortiz-Crespo (1982) concerned a female tagged in the Galapagos, subsequently recovered in the Boca de Buenaventura; E. imbricata has been more widely reported, from the Guapi, Mulatos, and Sanquianga estuaries, and on the reef off Gorgona Island. Olarte (1987) reported that the major turtle nesting beaches were south from Guapi to the Ecuadorean border. Enormous numbers of turtles (presumably L. olivacea) gather off the coast here, but some E. imbricata are also caught.

EXPLOITATION

Commodity Green Turtles are generally the most relished for meat, but other species are also eaten. In San Andres and Providencia, E. imbricata is said to be the preferred species for human consumption (Pritchard and Trebbau, 1984). The eggs of all species are collected. Turtle oil is used for many purposes: it is drunk as a cure for chest colds and asthma, spread on the skin as a sun-tan lotion and mixed with paint to make it glossy. Most of the oil comes from C. caretta and E. imbricata, as the fat of C. mydas is normally eaten. Hawksbill shell furnishes a large and thriving local jewellery industry, and some is sold for export, but the major use is for the manufacture of spurs for fighting cocks. Turtle leather is not currently used, partly because the popular method of cooking flippers involves leaving the skin on. All parts of slaughtered turtles are used: the carcases are ground up for pet food; the blood goes to make sausages; the bile is mixed with rum to make a general-purpose medicinal cure; carapaces and stuffed heads make ornaments; and the tails are dried to make an aphrodisiac "so powerful that if misused it can keep a man up for months" (Mast, 1986).

Hunting intensity In the Caribbean, turtles are regularly fished mainly on the Guajira Peninsula, but also between Punta Canoas and Taganga, in the Golfo de Moroscillo and in San Andres and Providencia. The main slaughterhouse is thought to purchase over 1250 turtles a year, of which about two-thirds are C. mydas and one-third E. imbricata. There are three other, smaller slaughterhouses. The total quantity of Hawksbill shell purchased each year by the main buyers is thought to be about 300-400 kg which, assuming a yield of 1.5-2.0 kg a turtle, represents some 150-266 large Hawksbills. The total annual mortality from deliberate fishing and as incidental catch by trawlers is estimated to be 2500-3500 C. mydas and 300-1000 E. imbricata. Virtually every turtle noticed nesting on the mainland coast is said to be killed, but more escape on the off-lying cays around San Andres (Mast, 1986). The nests on the beach near Acandi are subject to heavy human predation (Ramos Mora, 1987). On the Pacific coast, apart from some fishery of Bueno ventura, there is little deliberate hunting of turtles north of Tumaco, although there is a major shrimp fishery which may capture turtles accidentally. From Tumaco southwards, there is very intense exploitation of turtles, probably mostly L. olivacea, by locals and fishermen based in Ecuador. Some E. imbricata are also caught (Olarte, 1987).

Hunting methods Harpooning used to be the main method of turtle capture but now, most are taken with large-mesh nets, set for days at a time. This enables more turtles to be caught and facilitates keeping them alive longer for commercial sales. Significant numbers are killed opportunistically by scuba divers spearfishing or catching lobsters. The turning of nesting females occurs mainly from the eastern edge of Parque Nacional Tayrona to the mouth of the Rio Don Diego and in the outer cays of the San Andres Archipelago (Mast, 1986). Parsons (1972) described a net, used by fishermen in Providencia in the nineteenth century, which was attached to a five-foot iron hoop. This was dropped over the turtle when it rose to breathe. In Acandi, harpoons are mainly used by fishermen (Ramos Mora, 1987).

Historical trends Mast (1986) reported that the reduced abundance of turtles in Colombian waters was making them increasingly difficult for fishermen to catch.

Providencia has had a long tradition of Hawksbill fishery, and Yankee trading vessels used to visit the islands in the 19th century to collect

shell. The northern cays of Serrana, Serranilla and Roncador were often visited by Cayman fishermen. Most of the 5000 pounds (2 t) of tortoiseshell exported annually from the Cayman Islands between 1932 and 1939 were thought to come from Colombian waters (Parsons, 1972).

Domestic trade Turtle meat features regularly on the menus of restaurants in coastal districts, and around Riohacha it is the local speciality. Most of the Green Turtles caught are sold to local slaughterhouses because they fetch the highest prices. The less favoured Loggerheads tend to be used more for home consumption by the fishermen. The main slaughterhouse is in Riohacha; about 80% of the turtles are butchered, while 20% are sold live for use in fiestas. On the Pacific coast, the main trade centre is at Buenaventura and there are said to be two main traders dealing in Hawksbill shell, paying US$400-550 a kg. Most of the shell is used locally for cock spurs, but some is sold to dealers in Ecuador (Olarte, 1987).

International trade Domestic trade is thought to account for the great majority of the turtles killed in Colombia, with relatively little export. The local tortoiseshell industry is said to use so much shell that regular trips are made to Isla Margarita, Venezuela, to purchase shell. Japanese buyers are said to visit Providencia annually to purchase Hawksbill shell, for which they pay a high price (Mast, 1986). However, this is presumably declared as having originated elsewhere when it reaches Japan, as Japanese Customs statistics have recorded no imports of Bekko from Colombia since 1975. Imports before then are shown in Table 43.

Table 43. Imports of Bekko from Colombia reported in Japanese Customs statistics. There were no imports from 1950 to 1965 or from 1976 to 1986.

Year	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
kg	212	401	167	82	0	26	0	37	58	45

There is said to be a clandestine import to San Andres of Green Turtles caught off Costa Rica. When detected, such turtles are usually released by the authorities (Mast, 1986).

At one time, there was a small export trade in turtle leather to Italy from Riohacha, but this is said to have ceased (Mast, 1986). CITES reports (see below) provide some evidence of this.

Colombia ratified CITES on 31 August 1981. Apart from a single shell imported to the UK in 1985, the only records of trade in turtle products contained in the CITES Annual Reports have been of shells, carvings and bodies imported to the USA (ten C. mydas, 14 E. imbricata and one Cheloniidae, between 1980 and 1984) and of items made from C. mydas leather of Colombian origin re-exported by Italy (77 items between 1980 and 1982).

LEGISLATION

Resolucion No. 1032, 9 August 1977.
Prohibits all capture of E. imbricata.

Decreto No. 1608, 31 July 1978.
Applies to all wildlife except wholly aquatic species. Sets forth rules

concerning permits for hunting, capture and trade. Export of live animals is prohibited, except for scientific purposes if obtained under a commercial hunting permit from a licensed captive breeding facility, or under express authorisation from the President, for purposes of exchange. Hunting is prohibited except for subsistence purposes or collection for captive breeding. Import of species covered by a hunting ban is prohibited.

Decreto No. 1681, 4 August 1978.
Regulates the management of all aquatic biological resources, and confers responsibility for this on INDERENA.

POPULATION: Chelonia mydas

Nesting sites Frazier (1985) recorded only one *C. mydas* nest pit on Grande Comore and none on Anjouan; although not all beaches were examined by Frazier, suitable nesting habitat is very limited and *C. mydas* nesting on these two islands is likely to be very sparse. In contrast, Mohéli supports an important nesting population. A total of about 92 beaches exist on Mohéli and its satellite islets; 30 of the 84 beaches examined in 1972-1973 had evidence of *C. mydas* nesting (certain others had *C. mydas* remains, but no nests, and nesting was reported to occur on some other beaches) (Frazier, 1985). Twenty-four of these 30, mostly sites scattered around the main island, supported low intensity nesting; six showed high intensity nesting. Two of these sites are at the western extremity of Mohéli, three are on the island of Chissioua Ouénéfou (just south of Mohéli itself), and one - the most important single beach - is at the eastern extremity of Mohéli (Frazier, 1985).

Nesting numbers Frazier (1985) has provided estimates of *C. mydas* nests per year, and total nesting females per year on Mohéli, on the basis of field surveys he carried out in 1972 and 1973. These data are summarised in Table 44. Nesting numbers on Grande Comore and Anjouan, the two other main islands in the country, are insignificant.

Table 44. Estimates of numbers of nests and total nesting females per year on Mohéli (after Frazier, 1985).

	Nests per year	Females per year
24 minor beaches	1000	
Important beaches		
M'Sanga Nyamba (west)	600	
M'Samouheo	under 600	
M'Sanga Nyamba (east)	up to 1800	
Chissioua Ouénéfou		
west	600	
north	450	
north-east	450	
Sub total	4500	
TOTAL	5500	1850

Trends in nesting numbers No direct information is available. According to Frazier (1985), there is every reason to suspect that numbers have declined in the Comoro group, due to exploitation and habitat loss, although no comparative data are available. Frazier records being shown a house at Sambadjou on Mohéli once occupied by a turtler who worked the nearby beaches, but now unoccupied due to lack of turtles in the area. A beach survey in 1987 indicated that turtles were still nesting in large numbers on Mohéli (G.R. Hughes pers. comm., 1988).

Nesting season Nesting in Mohéli is known to occur from late February until late June, but is almost certain to extend from late January until late July; there is an increase from February onward, to a peak around

June. The peak appears to correspond with the trade wind season, in the austral winter (Frazier, 1985), which, if it is true, contrasts with nesting in Aldabra, which occurs in the austral summer. Hughes (pers. comm., 1988) reported nesting in October and November.

Foraging sites The islands of Grande Comore, Anjouan and Mohéli are relatively poor in coral reefs and seagrass shallows, in comparison with neighbouring Mayotte. No information is available on preferred feeding sites. Although C. mydas (including immatures) appears to occur widely in Comoros waters it is far less common around Grande Comore and Anjouan, with their often precipitous coastline and dense human population.

Migration No direct information is available. Frazier (1985) suggests that the Mohéli population may be resident around the island, and that C. mydas around Grande Comore and Anjouan, males and immatures in particular, may be migrants. Frazier speculates that migrants nesting in the Comoros would be likely to move to coastal Tanzania, or south into the Mozambique Channel, to feed.

POPULATION: Eretmochelys imbricata

Nesting sites Confirmed nesting is known only on Mohéli, with signs on at least 14 beaches, located in the south-west and around the eastern end of Mohéli, on Chissioua Canzoni and Chissioua Ouénéfou (islands off the south coast). Whilst E. imbricata has been recorded in waters around Grande Comore and Anjouan, most frequently of all around the former, breeding is not recorded (Frazier, 1985).

Nesting numbers Most of the nest beaches reported by Frazier (1985) held only one or a few E. imbricata nests, the chief exception being the north-east beach on Chissioua Ouénéfou, on which more than four nests were found in late February 1972 and 15 in early April 1972. Frazier (1985) characterises the Mohéli population (virtually equivalent to the entire Comoros nesting population) as small, with probably considerably fewer than 50 females nesting annually.

Trends in nesting numbers No direct evidence.

Nesting season Nesting appears to extend from late December until May (Frazier, 1985).

Foraging sites Typical known E. imbricata feeding habitat, namely, active and species-rich coral reef, is not widespread in the Comoros. Reefs are restricted in extent and diversity on both Grande Comore and Anjouan, but are better-developed around Mohéli, particularly in the south and around the offshore islands (where most recorded nesting occurs). Despite the apparent scarcity of preferred habitat around Grande Comore, reasonable numbers of E. imbricata occur there, all those encountered being immatures (Frazier, 1985).

Migration No direct information. Frazier (1985) speculates that there is likely to be some movement among the islands of the Comoro Archipelago, but that each island may have its own largely resident population.

EXPLOITATION

Commodity C. mydas is captured frequently and forms an important food

supplement to the local population, who are generally short of protein. E. imbricata is not often eaten, and is regarded as poisonous. Most of the population is Moslem, but only some appear to have religious objections to eating turtle. On Mohéli, immigrants from Anjouan are said to eat turtles but those from Grande Comore do not. There has formerly been a major trade in tortoiseshell from these islands, and small turtles are stuffed for sale to tourists (Frazier, 1985). The oil is rendered from the fat and used for various purposes, including the curing of asthma. Eggs are said not to be dug from the nests but may be removed from captured females (Bonnet, 1986).

Hunting intensity C. mydas is said to be generally taken whenever it is available. On the densely populated islands of Grande Comore and Anjouan, very few of the small number of nesting turtles escape, but hunting pressure is probably less on some of the other islands. On Mohéli, 14 of the 30 beaches known to support C. mydas nesting had the remains of slaughtered turtles. This led Frazier (1985) to conclude that the annual turtle crop was about 185, or 10% of the total nesting population on the island.

Hunting methods Most of the turtles are simply turned on the nesting beaches, but a few may be noosed or speared at sea. A small number of immature animals are accidentally caught in nets (Frazier, 1985). There are old reports (Petit, 1930, cited by Frazier, 1985), but no recent evidence, of the use of remoras for turtle hunting in the Comoros. Turtles are usually butchered on the beaches in a very wasteful manner. Oviductal eggs, calipee and a significant proportion of the edible meat is left to rot (Frazier, 1985).

Historical trends Frazier (1985) investigated the historical levels of trade in tortoiseshell from the Comoros, and found difficulty in separating the exports from those of Madagascar and other nearby islands. From at least as early as 1863 until 1917 it is clear that this region supplied appreciable quantities of shell to Zanzibar for onward distribution.

Domestic trade Frazier (1985) held that there "is no Chelonia trade of significance at either Grande Comore or Anjouan". On Mohéli, most of the meat is similarly used for home consumption, but at least one fisherman is said to carry it to sell in Fomboni (Frazier, 1985). The price per kg of meat in 1985 was said to be 100F CFA (US$0.28) in Mohéli, 500F CFA (US$1.34) in Grande Comore, and 400F CFA (US$1.07) in Anjouan (Bonnet, 1986). The present tortoiseshell trade is not thought to be very important, but in 1972 shell was said to be worth US$2.50 a kg. Small turtles of all species are stuffed and find a ready market with tourists. One hotel owner was said to purchase them from fishermen for US$3.75 and after injecting them with formalin, to sell them for US$10-25 each (Frazier, 1985).

International trade The Comoro Islands are not a Party to CITES. The CITES Annual Reports contain no reference to trade with the Comores in sea turtle products. The only record of trade in the Customs reports consulted was of a single import of 45 kg of raw bekko to Japan from the Comoros in 1980.

LEGISLATION

Decree No. 79019, Présidence de la République, 9 April 1979.
Prohibits the capture of all sea turtles in the territorial waters of the Comoro Islands and also in international waters.

No recent information is available on the occurrence of C. mydas and E. imbricata in the Congo Republic, nor on local exploitation of the species (B. Andzouana, in litt., 24 October 1986). Brongersma (1982) cited an 1882 record of C. mydas nesting at Loango (although this may refer to the "Loango Coast" area, in the former French Equatorial Africa, but now mainly or entirely within the present Gabon). There appears to be no record of E. imbricata, although the species might be expected to occur in Congo waters.

International trade Congo acceded to CITES on 31 January 1983. There is no record of trade in turtle products with Congo recorded in CITES Annual Reports.

LEGISLATION

Act concerning the conservation and exploitation of wild fauna. 3 May 1985.
Establishes the need to obtain licences for commercial exploitation of wild fauna. Traditional hunting is allowed with traditional weapons.

Turtles are not included in the list of species protected under the Order designating totally and partially protected species (3 May 1983).

POPULATION: Chelonia mydas

Nesting sites Most nesting occurs on Palmerston, but is also recorded on other atolls in the north of the group, including Pukapuka, Manihiki, Rakahanga, Penrhyn, and reportedly Suwarrow, Manuae and Takutea, also on the volcanic Rarotonga (N. Sims in litt., 28 August 1986; Balazs, 1982c).

Nesting numbers No numerical data are available; Sims (in litt., 28 August 1986) characterises nesting by C. mydas as "common" on Palmerston, "uncommon" on other northern atolls, "sporadic" on Takutea and Rarotonga, and overall nesting abundance as "low".

Trends in nesting numbers A local informant, cited by Balazs (1982c), stated that nesting numbers on Palmerston declined from 1972 to 1977 (and that the Island Council prohibited use of spearguns as a result). Whilst Palmerston has been cited as an important C. mydas nest site (e.g. Hirth, 1971), and nesting is now rated as minor (Sims in litt., 28 August 1986), suggesting that decline has occurred, past nesting levels have not been documented. Sims (in litt., 28 August 1986) suggests that numbers are now stable.

Nesting season Hatchlings have been recorded on Palmerston in January, suggesting that nesting occurs in November at least, but the extent of the season is unknown (Balazs, 1982c).

Foraging sites No specific information.

POPULATION: Eretmochelys imbricata

According to Balazs (1982c) the Hawksbill nests at Pukapuka, Penrhyn, and possibly Minihiki and Rakahanga, and others where unspecified sea turtles occur. According to Sims (in litt., 28 August 1986) the species does not nest, except possibly on Palmerston. No further information.

THREATS

The banning of spearguns at Palmerston in response to a decline in turtle nesting in the late 1970s implies that this hunting technique was perceived as a threat to turtle populations. Turtle exploitation, for eggs, meat and preparation of shells and immatures as curios, is seemingly widespread in the Cook Islands (Balazs, 1982c), but the acuity of the threat posed to turtle populations cannot be assessed. No other information is available.

EXPLOITATION

Commodity Turtle meat is regularly eaten on some of the islands, and there is some trade in shell products. Balazs (1982c) indicated that eggs were also eaten, but Sims (in litt., 28 August 1986) emphatically denied that this was the case. Turtle meat is said not to be readily accepted in Rarotonga, and turtles on Penrhyn were taken principally for their shell (Balazs, 1982c).

Hunting intensity Balazs (1982c) reported that turtles were eaten on Palmerston, Pukapuka, Manihiki, and possibly Penrhyn. The quantities involved are not known, although turtles were said to be frequently eaten on

Palmerston. About 50 turtles a year were taken on Penrhyn for the shell (Balazs, 1982c).

Hunting methods The use of spearguns for catching turles was banned on Palmerston in 1977 (Balazs, 1982c).

Historical trends No information, but Balazs (1982c) indicated that the tourist trade in shell products was growing.

Domestic trade In 1979, turtle meat shipped into Rarotonga from Palmerston was said to sell for US$0.45-0.90 a kg. Large shells fetched US$50 each, and there was some inter-island trade.

International trade Turtle shells are sold to tourists and visiting fishing boats. Some juvenile turtles preserved in formalin were said to have been sent to New Zealand (Balazs, 1982c). Fijian Customs statistics indicate the export of small quantities of worked tortoiseshell products to the Cook Islands in 1970, 1971 and 1984; and import from the Cook Islands in 1972 and 1973.

The Cook Islands are not party to CITES, and CITES Annual Reports indicated no trade with them in turtle products.

LEGISLATION

The Ministry of Marine Resources (N. Sims in litt., 28 August 1986) has confirmed that there are no legislative controls on turtle exploitation in the Cook Islands.

RANCHING/HATCHERIES

Following a recommendation in the 1950s, a local turtle-rearing effort was established on Palmerston. Each family on the atoll was said to rear 15 hatchlings in floating cages for 1-3 months for release to the wild in a restocking effort (Balazs, 1982c). Sims (in litt., 28 August 1986) confirmed that each family was still rearing two *C. mydas* a year to a length of about six inches. Balazs (1982c) related suspicions that some of the juvenile turtles were injected with formalin and sent to relatives in New Zealand, and indicated that a similar enterprise was occurring on Manihiki.

Experiments on turtle rearing were carried out on Rarotonga from 1974 to 1977 with support from the South Pacific Commission but problems with disease and the expense of food caused the project to be abandoned (Balazs, 1982c).

COSTA RICA: CARIBBEAN

POPULATION: Chelonia mydas

Nesting sites By far the most important area is the 22-mile (35-km) beach between the mouths of the Rio Tortuguero and Rio Parismina in the north of the country (Carr et al., 1978; Carr et al., 1982; WATS, 1984). Some turtles are also reported to nest in the area south of this, along 28 km of beach from the mouth of the Río Parismina to the mouth of the Río Matina, although no indications of abundance are given (WATS, 1984). It is not clear whether the species nests further south than this on the Caribbean coast.

Nesting numbers The Tortuguero colony is the largest surviving nesting population in the Caribbean and has been intensively studied since 1956. Intensive study has been confined to the first four miles (6.3 km) of beach (i.e. miles 0-4); numbers of nesting females recorded along this stretch are given in table 45 (from Bjorndal pers. comm., 23 April 1987). From these figures, and from several surveys of the whole beach during the nesting season, estimates of the total number of females nesting along the 35 km of beach can be derived. Such estimates, taken from Carr et al. (1982), for the years 1971-81 are given in Table 45; these estimates differ somewhat from those given in Carr et al. (1978) for 1971-76 and WATS (1984) for 1977-81 and it is understood that they are subject to recalculation (Bjorndal pers. comm., 23 April 1987). They should thus only be used to provide indications of the order of magnitude of the nesting population in any given year.

Table 45. Estimates of C. mydas and E. imbricata nesting at Tortuguero. C. mydas recorded in miles 0-4 (Bjorndal pers. comm., 23 April 1987); Total number of C. mydas estimated for miles 0-22 (Carr et al., 1982); number of E. imbricata encountered in miles 0-4 (Bjorndal et al., 1985; Bjorndal in litt. 24 July 1988).

Year	C. mydas mi 0-4	C. mydas mi 0-22	E. imbricata mi 0-4
1971	794	7 440	
1972	1 630	10 727	17
1973	963	11 829	5
1974	588	7 897	9
1975	644	10 171	8
1976	2 357	22 727	21
1977	429	5 464	18
1978	2 815	31 211	14
1979	413	5 178	15
1980	3 022	52 046	2
1981	586	8 430	8
1982	2 385		9
1983	1 501		7
1984	1 580		5
1985	1 268		6
1986			2
1987			9

Trends in nesting numbers The number of females nesting in season at Tortuguero has fluctuated widely from year to year. However no indication of any overall trend for the years 1956-81 has been given (population estimates for the years 1956-70 have not been located). However, Carr et al. (1978) stated that 1976 was the peak year for the period 1955-76; three years (1978, 1980 and 1982) in the period since then (up to 1985) have exceeded the total for 1976 (see Table 45). No information is available for other nesting sites in Costa Rica.

Nesting season Carr et al. (1978) note that except when there are very stormy periods (mostly in December) a few C. mydas nest almost every week of the year; the main breeding activity, however, takes place in July, August and September, with a peak in August.

Foraging sites There are foraging areas for C. mydas off the southern part of the Caribbean coast of Costa Rica, between Moin and the Panamanian border (Carr et al., 1982).

Migration International tag returns (numbering 1335 as of 1979) indicate that the Tortuguero colony is drawn from feeding grounds throughout the western Caribbean (Meylan, 1981). The great majority of tag recoveries are from the continental shelf of Nicarugua where there are extensive beds of Thalassia testudinum, although reasonable numbers have also come from Colombia, Panama, Mexico (Yucatan) and Venezuela (see Table 46).

Table 46. International tag recoveries from Tortuguero, 1956-1977. Source: Carr et al. (1978).

Nicaragua	957
Colombia	45
Panama	28
Mexico	26
Venezuela	25
Cuba	15
Honduras	8
Belize	1
Florida	1
Jamaica	1
Martinique	1
Puerto Rico	1
San Andres	1
	1110

Meylan (1981) notes that tracking evidence from turtles at Tortuguero indicates that at the end of the nesting season at least some individuals follow inshore routes, swimming against the current to return to northern feeding grounds.

POPULATION: Eretmochelys imbricata

Nesting sites Carr et al. (1982) note that some nesting by Hawksbills occurs along the entire Caribbean coast, especially between Tortuguero and Parismina in the north, and on the coral beaches from Cahuita to the Panamanian frontier in the south.

Nesting numbers The Hawksbill is far less abundant at Tortuguero than C. mydas; from 1955 to 1983, 246 nesting individuals were tagged in the northernmost 8 km at Tortuguero (i.e. miles 0-4), compared with 20 982 C. mydas at the same site during the same period, although monitoring did not take place during the peak Hawksbill nesting period (tagging was only carried out during the Green Turtle nesting season) (Bjorndal et al., 1985); only 12 remigrant Eretmochelys were recorded in this period. More consistent efforts were made to count from 1976 onwards, and these figures are given in Table 45.

Trends in nesting numbers Carr and Stancyk (1975) cite evidence of a considerable decrease in density of nesting females at Tortuguero since 1956: in the period 1956-59, 3.7 Eretmochelys were tagged per patrol-hour per mile (= 2.3 per patrol-hour per km) in nightly patrols of the study area at Tortuguero (miles 0-4); in 1970-73, 0.97 per patrol-hour per mile (= 0.60 per patrol-hour per km) were tagged at the same site. Bjorndal et al. (1985) stated that the data before 1972 could not be used because of differing methodology, but that from 1972 onwards beach coverage had been reliable, and the data showed no consistent trend in the number of Hawksbills seen in the patrolled area during the period 1972-83, or in the number of nests recorded during July, August and September beach surveys, suggesting that the population may have stabilised. However, Bjorndal later pointed out (in litt., 24 July 1988) that the counts prior to 1976 were unreliable and that if the data from 1976 to 1987 were considered (Table 45) a significant decline was apparent (Pearson's $r = -0.757$, $p = 0.0044$). In addition Bjorndal et al. (1985) noted a slow though steady and statistically highly significant decline (slope = -0.15; $p = 0.0005$, Spearman rank correlation) in carapace length of nesting females over the period 1955-77, suggesting that the population is not demographically stable.

Nesting season Carr et al. (1966) state that the nesting season at Tortuguero is essentially May to November. Systematic observations were only made during the Chelonia mydas nesting season but they considered at the time that peak nesting was probably in May and June prior to the C. mydas season; Bjorndal et al. (1985) also report a significant increase in nesting activity in October immediately after the C. mydas season.

Foraging sites Bjorndal et al. (1985) report that the Caribbean coast is poor in what is generally considered Eretmochelys habitat. They state that it is not clear whether any of the Hawksbills that nest at Tortuguero are resident in Costa Rican waters, although there is a record of a female taken near Puerto Limón south of Tortuguero one year after being tagged while nesting (i.e. almost certainly in a non-nesting year); the best coral reef habitat on the coast is at Cahuita south of Puerto Limón, and Eretmochelys is known to occur there (Wells, 1988a), although whether year-round or not is unclear. Carr et al. (1982), however, state that concentrations of mature Hawksbills are found foraging on Tortuguero Bank, two patches of rock lying c. 1 km off the mouth of the Tortuguero River, throughout the year, though especially in late spring. They also note that immature Hawksbills of all post "lost year" sizes are found off southern Costa Rica between Moin (just north of Puerto Limón) and the Nicaraguan border.

Migration Bjorndal et al. (1985) report nine international tag recoveries; eight of these have come from the region of the Miskito Cays and other shallow banks off the coast of Nicaragua and Honduras, the major feeding ground of the Tortuguero Green Turtles, and one was taken near Colon, Panama. There is no information on migration in the Pacific population.

THREATS

Exploitation of turtles and eggs and incidental take are the major identified threats although the incidental take in the Caribbean waters of Costa Rica is unclear. Predation by domestic dogs is evidently high in some areas. Fowler (cited in Bjorndal, 1980) estimated that one third of the nests on Tortuguero Beach were destroyed by dogs.

EXPLOITATION

Commodity Green turtles were, at least up to 1982, legally harvested on the Caribbean coast. Meat, oviductal eggs and oil are all utilised (WATS, 1984). The centre of the market is Limón; it is noted in WATS (1985) that demand in other states is far lower and that few supermarkets in the capital sold turtle meat. Bjorndal et al. (1985) note that the Tortuguero Hawksbill population is still subject to heavy exploitation for the tortoiseshell trade; it is unclear how much of this takes place in Costa Rican waters.

Hunting intensity Table 47 gives official harvest figures (from the Limón regional office of the Departamento de Pesca of the Ministerio de Agricultura y Ganadería). The legal harvest is apparently based at Puerto Limón; in 1982, 19 boats were licensed by the Fisheries Department in Puerto Limón to fish turtles during the open season (June-August) (WATS, 1984).

Table 47. Harvests of Chelonia mydas in Costa Rica (Caribbean coast)

Year	1982	1981	1980
No. taken	1547 (761 male)	690	576

The extent of illegal and unrecorded harvest of C. mydas on the Caribbean coast is unclear, although it is certain that both turtles and eggs are taken. The extent of harvest of Eretmochelys is also unclear, although Bjorndal et al. (1985) state that the species is still exploited in Costa Rica; none is recorded in WATS (1984). Intensity of nest poaching is evidently at least locally high (Bjorndal et al., 1985).

Hunting methods Turtles are principally taken with harpoons and nets (Carr et al., 1966 and 1978). Turtling is only allowed over 7 km from shore, although Carr et al. (1978) noted that at that time turtle fishermen often approached the shore at Tortuguero much more closely, intercepting the breeding turtles, often when they were preoccupied with mating.

Exploitation of C. mydas on the Caribbean coast has apparently been higher in the past. Parsons (1962) reported that at that time the beach at Tortuguero was leased in ten-mile (16 km) sections to contractors for turtle turning and egg collecting. During the season (15 June-15 August) around 2000 females were turned. Legally females were only to be taken after they had laid, but Parsons noted that this restriction was certainly unenforced. The turtles were taken to Limón where they were kept alive until sold; some were exported, with the best market apparently being Colón in Panama. The harvest was reportedly limited by demand. The number taken elsewhere in

Caribbean Costa Rican waters at this time is not reported. Carr et al. (1978) estimate that the annual take in Costa Rica immediately prior to 1976 had been as high as 4000 C. mydas. In 1976 the season on turtling for international commerce was closed "indefinitely" leading to the shutting down of two turtle packing plants which had been supplying the international market.

Historical trends Demand for and hunting intensity on Hawksbills has evidently fluctuated. Parsons (1962) reported that the annual take at Limón (the centre of the trade) was estimated by the US Consul there as around 750. Carr (1966) reported that in the mid-1950s, because of the recent introduction of plastic substitutes, there was no market in Costa Rica for tortoiseshell; a mature Hawksbill thus had no commercial value except as food for the small segment of the population which would eat them. By the mid-1960s there had been a resurgence in the demand for genuine tortoiseshell as well as a growing market for the skins and a steady trade in Hawksbill "calipee" for the soup trade. A single Hawksbill was worth up to $14 to a fisherman, more than the normal week's wages. Young were also taken to be polished and mounted for the curio trade.

Domestic trade As noted above, the only legal turtle trade (at least up to 1983) was for local consumption. WATS (1984) reports that the only plant licensed to process turtle was the Coopepesla Cooperative at Cieneguita. In the 1982 season (June-August) it reportedly processed 315 C. mydas. Presumably the remaining 1232 legally taken (see Table 47) were processed locally. The market value of each turtle was estimated at 750-1000 Colone for females and 600-900 Colone for males (US$1 = 48.20 Colone, February 1985). Meat was valued at c. 50 Colone a kg (WATS, 1984).

International trade According to CITES reports, from 1977 to at least 1983 there was virtually no legal international trade in turtles or turtle products from Costa Rica. In 1977, 2000 C. mydas eggs were exported from Costa Rica to Bermuda and 70 live C. mydas were exported to the USA. Since then the only recorded commercial trade was 191 skins of C. mydas, origin Costa Rica, exported from F.R. Germany to South Africa in 1981, reported by F.R. Germany. Some illegal trade is believed to take place, though no details are available. From 1966 until 1972, Costa Rica exported up to ten tonnes of turtle products per year to the USA (Wells, 1979). The 1976 Costa Rican CITES report indicates considerable quantities of C. mydas products exported to the USA and the Netherlands, including a total of over 27 000 kg of calipee, flippers, trimmings, meat and shell and 2400 litres of oil. The F.R. Germany reports importing over 12 tonnes of soup and meat from Costa Rica between June and December 1976 and 15.5 tonnes apparently from Costa Rica via Somalia.

There has been some trade in tortoiseshell exported to Japan, at least until 1983, although this is not reported in CITES annual reports.

Table 48. Exports of bekko from Cost Rica to Japan, reported in Japanese customs statistics, 1972-86.

Year	1972	'73	'74	'75	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86
kg	387	285	175	515	170	260	47	89	–	234	79	5	–	–	–

COSTA RICA: PACIFIC

POPULATION: Chelonia mydas

Nesting sites Few details are available for the Pacific coast; C. mydas is said to be locally common, although the extent of nesting is unclear (Cornelius, 1981). Green Turtles definitely nest at Playa Naranjo and Playa Nancite in Santa Rosa National Park in the Gulf of Papagayo (Cornelius, 1986) and are reported to nest in Corcovado National Park on the Peninsula de Osa (IUCN, 1982).

Nesting numbers On the Pacific coast, C. mydas is said to nest in "moderate numbers" at Playa Naranjo and infrequently at Playa Nancite in Santa Rosa National Park (Cornelius, 1986). No information is available for other nesting sites.

Foraging sites There are reportedly no large areas of seagrass off the Pacific coast and it is unlikely that there are any large scale feeding grounds; Cornelius (1981), however, has suggested, on the basis of the discovery of numerous moribund sub-adults on the north-west coast of Guanacaste in 1972, that C. mydas may be resident in Pacific Costa Rican waters, or alternatively that juveniles participate in seasonal movements.

Migration There are few data for the Pacific coast, although three turtles tagged in Galápagos and one at Michoacan (see GALAPAGOS and PACIFIC MEXICO accounts) have been recovered in Costa Rican waters.

POPULATION: Eretmochelys imbricata

Nesting sites The species is known to nest, although is evidently uncommon (Cornelius, 1981 and 1986). It is reported to nest in Corcovado National Park on the Peninsula de Osa, in Manuel Antonio National Park in Puntarenas Province and perhaps in Santa Rosa National Park in Guanacaste (IUCN, 1982; Boza and Mendonza, 1981).

Foraging sites Along the Pacific coast, Hawksbills are reportedly most often seen around the rocky outcrops that characterise the Guanacaste coastline; immatures are reportedly much commoner than adults and in general the species is more frequently recorded in the sea than nesting (Cornelius, 1986).

THREATS

Cornelius (1981) noted that on the Pacific coast large numbers of turtles were caught by shrimp trawlers, especially along the coast of Guanacaste Province. Islas Negritos, Punta Guiones, Cabo Velas and the Gulf of Papagayo were cited by shrimpers as areas with high incidental catch rates; Cornelius also thought it likely that turtles were taken in the other major shrimping grounds in Colorados Bay and the Ducle Gulf. He reported that estimates of catch rates differed, most ranging from 600 to 2000 annually by the fleet of 61 trawlers, although some estimated over 200 juveniles and adults taken daily in late spring and early summer; most were Olive Ridleys. Those that arrived on deck alive and some of the dead were returned to the sea. Cornelius noted that this was a probable explanation of the relatively large number of carcasses observed on Costa Rican beaches (see above).

EXPLOITATION

Commodity Cornelius (1981,1986) notes that consumption of sea turtle meat is to some extent culturally unacceptable on the Pacific coast; there is thus no tradition of large scale local harvest of adults for meat. Eggs have, however, been taken on a large scale, and this practice doubtless continues despite being illegal. The great majority of eggs harvested would certainly have been Olive Ridley (most taken at Ostional in Guanacaste), although other species are taken when encountered. Eggs not only were consumed locally but also supplied markets in the central highlands of the country (Cornelius, 1981 and 1986).

There is reportedly little if any organised fishery of Hawksbills along the Pacific coast of Central America, mainly because the species is now too rare. Cornelius (1986) notes, however, that lacquered shells (usually of juveniles) are often seen hanging on walls of bars and restaurants in tourist and fishing villages.

Hunting intensity Cornelius (1981) noted that no permits had been granted, or possibly requested, for the capture of sea turtles on the Pacific coast since 1977.

Domestic trade As noted above, eggs from the Pacific coast have supplied inland markets; it is likely that this practice continues.

International trade See COSTA RICA: CARIBBEAN above.

LEGISLATION

Ley de Caza y Pesca Maritima (Ley No. 190), 28 September 1984.
    Allows limited trade in meat of C. mydas. Costa Rica currently has an annual quota of 1000 green sea turtles.
    Prohibits hunting and commerce in all other sea turtles.

POPULATION: Chelonia mydas, Eretmochelys imbricata

Little information is available. Gavilan and Andreu (1983) reported that most turtle nesting occurs on the cays and islands of southern Cuba, in particular at Cayo Largo del Sur, Isla de la Juventud (Playa Larga and Rincon Frances), Cabo Corrientes and the Jardines de la Reina ("Gardens of the Queen", a chain of islands off the south coast), including Cachiboca, Cayo Grande, Cinco Balas and Cayo Caguama. Both C. mydas and E. imbricata nest, also Caretta caretta, although no information is available on specific sites and numbers. Coral reefs and bays, providing feeding habitat, are extensive and turtles appear to occur throughout the area. According to Gavilan and Andreu (1983) the Jardines de la Reina (Laberinto de las Doce Leguas), Golfo de Batabano and Ensenada de la Broa (in the south-west), are the principal turtle foraging grounds. Anon. (1986a) reported that a Ministry of Fisheries staff member considered C. mydas to be the most abundant turtle in Cuba, whereas fishermen claimed to catch more E. imbricata. Sources also reported that only E. imbricata has a resident population, and that the species is abundant around Isla de la Juventud (Isla de Pinos) (Anon., 1986a). A decline in numbers of C. mydas caught (see below) may reflect decline in nesting numbers or in foraging numbers.

EXPLOITATION

Commodity Both C. mydas and E. imbricata are captured in Cuba for food. There is a major trade in the shell of E. imbricata, mostly for export, and some shell of C. mydas is used for marquetry on the island. Fat and oil is used locally for perfumery and soap manufacture, and skins are tanned. Turtle eggs are occasionally eaten illegally and are regarded as an aphrodisiac (Anon., 1986a).

Hunting intensity All turtle fishing is carried out by state co-operatives, and is under state control. There is thought to be little illegal capture of turtles, and the close season is generally observed. During the close season, fishermen are paid a fixed salary and are not permitted to land turtles (Anon., 1986a). Consequently, the official catch statistics as supplied to FAO (Table 49) probably give a fair impression of the harvest. The figures in Table 49 agree with those provided by Gavilan and Andreu (1983) for 1980 to 1982.

The main ports from which turtle fishing is carried out are Niquero, Santa Cruz, Casilda, Cienfuegos, Isla de Juventud, Coloma, Arroyos de Mantua and Puerto Esperanza (Gavilan and Andreu, 1983). The most important fishing grounds are around the offshore islands, particularly, Cayo Breton, Jardines de la Reina, Cayo Guano, Cayo Largo, and Isla de Juventud (Pinos) off the south coast; and to the north, Archipielago de Sabana and Camaguey (Anon., 1986a).

Hunting methods Most turtles are caught off shore using nets with a 150-mm mesh size. The boats usually make protracted journeys, and the turtles are usually dead when they are landed. Very few turtles are thought to be captured on the nesting beaches (Anon., 1986a).

Historical trends Parsons (1972) mentioned the Archipelago of Jardines de la Reina as being one of the earliest (18th century?) centres for tortoiseshell trade in the Caribbean. The islands used to be visited by turtle fishermen from Cayman Brac.

Table 49. Catches of marine turtles in Cuban waters (in t) recorded in FAO fishery statistics. Before 1979, catches were only given to the nearest 100 t, however more accurate figures for 1976-78 were obtained from Marquez (1984a); " - " represents less than 100 t, but more than zero.

Year	C. mydas	E. imbricata	C. caretta	Others	Total
1965	100	-	-	0	100
1966	100	-	-	0	100
1967	200	-	-	-	200
1968	500	200	500	-	1200
1969	300	200	600	-	1100
1970	300	200	500	-	1000
1971	400	200	400	-	1000
1972	500	200	500	-	1200
1973	400	300	500	-	1200
1974	400	300	500	0	1200
1975	500	300	500	0	1300
1976	331	205	298	0	500
1977	321	201	295	0	800
1978	329	202	284	0	800
1979	200	200	300	0	700
1980	269	263	320	28	880
1981	235	253	249	177	914
1982	376	285	260	1	922
1983	354	263	273	34	924
1984	211	291	277	39	818
	6245	4055	5279	279	15858

Declared catches of turtles are given in Table 49. An average of 793 t has been caught each year since 1965, of which 39% has been C. mydas and 26% E. imbricata. Peak catches were between 1968 and 1972, and since then, the catch of C. mydas seems to have declined by some 40%. The catch of E. imbricata does not appear to have dropped to the same extent. A fisherman interviewed in 1985 reported that "ten years ago, you could catch 80 or 100 turtles in ten days; nowadays we catch six or seven in the same period." (Anon., 1986a).

Domestic trade A fisherman interviewed at Batabano revealed that the crews received 70% of the value of the turtles that they landed. The Co-operative paid Ps900 (US$1260) for a ton of E. imbricata and Ps500 (US$625) for a ton of C. mydas. Turtle meat is a delicacy and is served in many restaurants. Some is also consumed locally near the fishing ports. There are numerous workshops on the island using turtle materials. A 40-cm stuffed Hawksbill was said to sell for US$540 and mounted, stuffed heads of C. mydas for US$17. Virtually all of the Hawksbill shell is said to be taken to Cojimar for export (Anon., 1986).

International trade Cuba is not a Party to CITES and has a large export trade in tortoiseshell, particularly to Japan and France which has or has had, respectively, reservations on E. imbricata. The only trade in turtle products from Cuba recorded in CITES Annual Reports, apart from imports to the USA of a total of seven shells and bodies, has been the import to France

of 250 kg, 215 kg and 75 kg of E. imbricata shell in 1983, 1984 and 1985 respectively.

Japanese Customs statistics probably give the best indication of the quantities of tortoiseshell exported. These are shown in Table 50.
The great majority of the imports were of bekko (E. imbricata). There was a marked increase in the trade volume in 1968, there having been an annual average of 2108 kg in the ten years previous to that, and 5879 kg since then. This corresponds with the date at which the FAO statistics started recording catches of E. imbricata (Table 49), though whether it indicates the onset of fishing for this species or merely the onset of systematic collection of statistics is not known.

Table 50. Imports of raw bekko and other tortoiseshell from Cuba reported in Japanese Customs statistics (in kg). There were no imports reported in 1951 or 1952.

Year	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Bekko	299	231	0	0	0	0	749	1034	3131	3292	2825	1533
Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Bekko	1303	2054	3013	2146	6819	7632	5435	5946	5100	8100	6245	6100
Other shell	0	0	0	0	0	0	0	0	0	200	0	0
Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	
Bekko	6975	3984	6600	3725	7338	2050	6933	5017	4200	7816	5688	
Other shell	10	0	0	750	225	0	950	0	460	0	0	

LEGISLATION

Since 1976, the Ministerio de la Pesqua has had the power to impose restrictions on turtle capture (Gavilan and Andreu, 1983). Current regulations include:

A close season from 1 June to 31 August.
A minimum size limit of 50 cm.
A total ban on the collection of eggs, hatchlings and the destruction of nests.

Decreto Ley 103.
All capture of turtles for recreational purposes is forbidden.

A report by Greenpeace (USA) indicated that only fishermen working for state fisheries co-operatives were authorised to catch turtles (Anon., 1986a).

RANCHING/HATCHERIES

Since 1965, hatcheries and head-starting facilities have been established at Cayo Boca Rica (Jardines de la Reina), Cayo Largo del Sur (Canarreos), Playa Larga (Isla de Juventud), Cabo Corriente (Peninsula de Guahanacabibes) (Gavilan and Andreu, 1983).

A more detailed description of the Cayo Largo hatchery was obtained in 1985 (Anon., 1986a). Some eggs are collected from nearby nesting beaches and hatched in wooden containers; others are merely protected in situ with wire

netting. Hatchlings are kept for about three months before being tagged and released. The ranch is said to have a capacity for 10 000 hatchlings, and to release about 20 000 a year. The reported hatching success rate (10-15%: Anon., 1986a) seems unbelievably low and may be incorrect. The ranch also maintains a small captive-breeding group of mature females, totalling 16 animals of three species. These were said to be mated with wild males. The operation is allowed to slaughter a certain number of (wild?) turtles at the rate of one for every 600 eggs hatched. A total of 85 were killed over a three-year period. One peculiarity of the Cuban hatcheries is that they are said to take some eggs from females slaughtered at the ports, which can apparently be done within 32 hours of death.

POPULATION: Chelonia mydas

Nesting sites A small number of *C. mydas* nest in the west, chiefly around the Akamas Peninsula, notably in the Lara area. Beaches in the Lara region include, in south to north order, Toxeftra (c. 1 km), Ayiie Phanentes (1.5 km), and Lara south, central and north beaches (3 km in total). No regular *C. mydas* nesting is known to occur elsewhere in southern Cyprus (Demetropoulos pers. comm., 10 July). Nesting also occurs in Northern Cyprus. Most nests recorded in 1988 were on beaches toward the tip of the Karpas Peninsula, either within or just outside the boundary of the proposed Zafer Burnu National Terrestrial and Marine Park. The most important site consists of a bay about 3.75 km north-west of the village of Dipkarpaz, with a beach some 1.6 km in length, partially divided by small rock headlands.

Nesting numbers The *Chelonia* population based at Lara is estimated to comprise around 100 turtles (Demetropoulos and Hadjichristophorou, 1987). This estimate is intended to include mature males, and is based on the possibility that females typically nest in alternate years (Demetropoulos and Hadjichristophorou pers. comm., 9 July 1988). On this basis, some 25 female *Chelonia* may use the Akamas beaches each season. During a ten-day period in early July 1988, in what was considered locally to be a good year for Green Turtle nesting, the mean nesting rate was about one nest per night in the entire Lara area (Demetropoulos pers. comm., 10 July); this is equivalent to about 0.2 nests/km/night. A total of 96 fresh *Chelonia* nests was recorded on 28 beaches in Northern Cyprus during a preliminary survey between 18 June and 14 July (Groombridge and Whitmore, unpublished). Nesting rate near Dipkarpaz was just over 1 nest/km/night. If each female laid three clutches, a minimum of 32 females could have produced the observed total of 96 nests, however, other females will have nested before and after the survey period, and an estimate of 50 females is probably close to the seasonal total in 1988. The only beaches in Northern Cyprus not investigated are around Güzelyurt (= Morphou) Bay in the west; Ramsay (1970) and Demetropoulos (pers. comm., 1988) confirm that some turtle nesting occured here in the past, and local residents indicate that turtles still nest. The species and numbers involved are not yet known, although Ramsay (1970) stated that Green Turtles nested, and that eggs were sometimes collected.

Trends in nesting numbers Little firm evidence is available, although Demetropoulos and Hadjichristophorou (1987) state that both *Caretta* and *Chelonia* were more abundant in the past; this is based on reports from fishermen, and on the name of one locality (Khelones) in northern Cyprus, which suggests that it was notable for good numbers of turtles. At least one beach (Potima, in the Lara area) used to support sparse *Caretta* nesting but now no longer does so, following sand extraction and construction of a sea wall (Demetropoulos and Hadjichristophorou pers. comm., 9 July 1988). Other beaches near Larnaka and other tourist sites almost certainly once held more nesting turtles than the negligible number now present. Overall, whilst turtle populations seem certain to have been larger in the past, there are no reliable historical data on past numbers, and thus on the magnitude of their apparent decline.

Nesting season Nesting by both *C. caretta* and *C. mydas* occurs between early June and mid-August (Demetropoulos, 1981 and 1983).

CYPRUS

POPULATION: Eretmochelys imbricata

There are no records of Hawksbill in Cypriot waters.

THREATS

Tourism and agriculture are the main sources of income on Cyprus, and most beaches in the southern part of the island are already adversely affected by tourist development and are now totally unsuitable for turtle nesting (Hadjichristophorou pers. comm., 2 September 1987); the remaining relatively undisturbed beaches, all in the Akamas area, are threatened by development plans.

Beaches in Northern Cyprus are mostly relatively undisturbed at present, and some, primarily along the Karpas Peninsula, are virtually pristine (apart from presence of seaborne debris). Tourist development, however, is spreading westward and eastward from the main centre of Girne (= Kyrenia) midway along the north coast, and several parts of Gazi Magusa (= Famagusta) Bay are used as beach resorts. Plans exist for tourist development at some important turtle nesting beaches, and disturbance appears to be increasing in parallel with increasing tourism.

Most beaches appear to be affected by pollution, in the form of tar balls and plastic litter, probably seaborne. Although nesting turtles must sometimes crawl through accumulations of such debris, the effect on nesting success is unknown (the visual amenity value of such beaches is of course diminished). Beaches in the Lara area are manually cleaned at intervals, and they tend to remain clear of litter for quite long periods (Demetropoulos, pers. comm.).

A significant number of turtles are caught in Northern Cyprus, apparently by accident, as a result of fishing activities. Most or all are caught in set nets near to shore, often near nesting beaches, and many are drowned. Estimates of the number so caught in Northern Cyprus range from 10 to 50 animals per year; if a high proportion are mature animals, incidental catch will be having a severe adverse effect on the turtle population, which is not large. Demetropoulos and Hadjichristophorou (1987), referring to southern Cyprus, reported that turtles are occasionally killed on the beach for their shell, and some turtles are drowned or killed when caught in fishermen's nets; although turtle populations have reportedly suffered as a result, no data are available on the numbers lost.

EXPLOITATION

Hunting intensity There seems to be very little direct exploitation of sea turtles in Cyprus. Occasionally turtles are still killed on their nesting beaches for their shells, and some may be caught in fishermen's nets (Demetropoulos and Hadjichristophorou, 1986). In 1982, a fisherman was fined £30 after being found with the shell of a C. caretta in his boat, and this is said to have had a noticeable deterrent effect on other fishermen (Anon., 1982).

International trade There is no evidence of any international trade in turtles from Cyprus, except for two exports of leather items from Italy in 1981, said to have originated in Cyprus. This may have been a typographical error in the ISO country code for Cayman Islands.

LEGISLATION

Fisheries Regulations, Cap. 135, 1971.
All turtles and their eggs are protected.

RANCHING

The Cyprus Fisheries Department has operated a hatchery scheme since 1978. The scheme has no commercial interest, and is purely for conservation purposes.

Eggs are removed from their nests and brought to a central hatchery at Lara. Where protection can be given at the nest site, there has been a recent tendency to leave the nests where they are laid and to cover them with cages (Demetropoulos and Hadjichristophorou, 1986). The majority of the hatchlings are released immediately; totals of 1125, 1782 and 1650 C. mydas hatchlings were released in 1980, 1982 and 1983, respectively (Demetropoulos, 1981, 1983 and 1984). A small proportion are reared to various sizes, either in floating sea cages in Paphos harbour or in the laboratory at Nicosia. Some of these are used for research and some are tagged and released after a few years. In 1982, it was planned to release 24 four-year-old turtles and 24 two-year-olds (Demetropoulos and Hadjichristophorou, 1982). In 1986, there was a total of about 60 turtles in captivity (Demetropoulos and Hadjichristophorou, 1986).

DJIBOUTI

Very little information is available. Both Green and Hawksbill Turtles evidently occur (Anon., 1982d). Observers in 1982 were told that sea turtles "often" came ashore to nest (Anon., 1982d).

EXPLOITATION

Hunting intensity It was reported in 1982 that, although protected by legislation, turtles were often killed and their eggs taken (Anon., 1982d).

Historical trends There is no direct evidence for historical levels of exploitation of sea turtles in Djibouti, but Lafon (1986) reported seeing quantities of turtle bones on an island near the Ethiopian border.

Domestic trade Carapaces from both C. mydas and E. imbricata were reported to be sold openly in the market and tourist shops (Anon., 1982d).

International trade There is no evidence of extensive international trade in turtle products, although it is possible that the products on sale in the tourist shops are of imported rather than indigenous origin. CITES Annual Reports reveal no international trade in sea turtle products involving Djibouti.

LEGISLATION

Protection of Fauna and Marine Resources, Décret No. 85-103/PR13. (Ministère de l'Agriculture in litt., 14 December 1986).

The capture of sea turtles and the collection of their eggs is forbidden. There are no controls on the sale of products

POPULATION: Chelonia mydas

Nesting sites Gregoire (1984) reported nesting at Batali Estate Beach and Salisbury Beach, and possible nesting at Toucari Bay Beach and Mero Beach. Carr et al. (1982) considered the best nesting beaches to be those in the Portsmouth area (Point Ronde to Toucari), and at Hampstead Beach, Castle Bruce, and Bout Sable. Bacon (1981) reported nesting at Scott's Head, Canefield, Tarou, all bays between Salisbury and Portsmouth, Douglas Bay, Thibaud, Melville Hall, Rosalie, and La Plaine.

Nesting numbers Gregoire (in litt., 6 October 1986) considered nesting to be of low abundance and Edwards (1984) reported only three confirmed nests in 1982. Bacon (1981), however, considered nesting to be frequent.

Trends in nesting numbers Gregoire (in litt., 6 October 1986) considered the Green Turtle nesting population to be decreasing.

Nesting season Carr et al. (1982) reported the nesting season to begin a "little later" than that of the Hawksbill (May to October). Nesting reported by Edwards (1984) occurred in August and September.

Foraging sites Edwards (1984) reported foraging at Toucari Bay, Salisbury, Castle Bruce and Hampstead Beach. Carr et al. (1982) noted the setting of nets at presumed feeding areas along the windward coast, between Delices and Castle Bruce, and along the north coast at Calibishie.

POPULATION: Eretmochelys imbricata

Nesting sites Nesting sites were reported at Toucari Bay, Petite Baie, Batali Estate Beach, Salisbury Beach, and Rockaway Beach (Gregoire, 1984). Carr et al. (1982) reported the best nesting beaches to be in the Portsmouth area (Point Ronde to Toucari), and at Hampstead Beach, Castle Bruce, and Bout Sable. Nesting was also reported by Bacon (1981) at Scott's Head, Canefield, Tarou, Mero, Douglas Bay, and all bays between Salisbury and Portsmouth.

Nesting numbers Gregoire (in litt., 6 October 1986) considered Hawksbills to be nesting in low abundance. Only six confirmed nests were reported by Edwards (1984), though the number of reported nesting sites suggests a larger nesting population. Bacon (1981) considered nesting to be occasional.

Trends in nesting numbers Gregoire (in litt., 6 October 1986) considered the Hawksbill nesting population to be decreasing.

Nesting season Nesting recorded by Edwards (1984) occurred from April to October. Carr et al. (1982) considered the nesting season to be May to October.

Foraging sites Edwards (1984) reported foraging at Toucari Bay, Salisbury, Castle Bruce and Hampstead Beach; and Carr et al. (1982) noted the setting of turtle nets at probable foraging sites at Calibishie and between Delices and Castle Bruce.

THREATS

Sand mining was apparently in progress at Batali Estate (Edwards, 1984).

EXPLOITATION

Commodity The meat and eggs of Green Turtles and Hawksbills were consumed locally and Hawksbill shell was sold for export (Carr _et al._, 1982). According to Edwards (1984) skins and stuffed juveniles were of no importance and Hawksbill shell was not worked locally.

Hunting intensity Edwards (1984) reported the activities of foreign fishermen in Dominican waters but could not estimate their numbers or the quantity of their catch.

Hunting methods Foreign fishermen were reported to fish at night using lights (Gregoire, 1984).

Domestic trade Edwards (1984) reported the price for Green Turtle and Hawksbill meat to be EC$2.50 a lb (EC$5.50 a kg) and the price of Hawksbill shell to be EC$15-20 a lb (EC$33-44 a kg). Carr _et al._ (1982) noted the price of turtle meat to be EC$2.00 a lb (EC$4.40 a kg).

International trade Carr _et al._ (1982) noted the activities of French buyers who travelled around the island to buy Hawksbill shell, at EC$12.25 a lb (EC$26.40-55 a kg), for export to the French Antilles. A trader from Martinique, Mr Albert, regularly visited Dominica to buy Hawksbill shells from fishermen. He would give them tangle nets, buy the shells, and let them keep the meat. He would pay EC$15-20 a lb (EC$33-44 a kg) for the shells (Gregoire, 1984). Gregoire (_in litt._, 6 October 1986) noted the export of raw Hawksbill products and the import of goods manufactured from both Hawksbills and Green Turtles.

Dominica is not covered by the UK's ratification of CITES. CITES annual reports for the period 1977-1985 record imports to the USA from Dominica of two shells of _E. imbricata_ (one via another country) in 1983; four carvings of Cheloniidae (all via other countries) also in 1983; and one Cheloniidae body in 1984.

Japanese imports of bekko from Dominica are given in Table 51.

Table 51. Japanese imports of bekko (kg) from Dominica, 1962-1986, reported in Japanese Customs statistics:

1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	
604	1343	1767	1549	1820	1352	1178	-	-	-	-	6	
1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
-	-	126	-	-	144	90	60	39	40	-	174	219

LEGISLATION

Turtle Ordinance, 24 November 1972.

It is prohibited to catch or take turtles or their eggs between 1 June and 30 September inclusive. The capture or taking of turtles under 20 lb (9 kg) is prohibited. It is prohibited to buy, sell or expose for sale, or have in possession, turtle flesh or eggs between 1 June and 30 September inclusive. Permits may be granted for the collection of wildlife for scientific or educational purposes. It is illegal to disturb any turtle nest or eggs, or to take or attempt to take, any turtle laying eggs or on the shore engaged in nesting activities.

POPULATION: Chelonia mydas

Nesting sites Nesting is widely dispersed, occurring on beaches along most sections of the coastline (see Table 52). Ottenwalder (1981) found no evidence of concentrated nesting.

Nesting numbers Estimates for 1981 are given in Table 52; estimated total population was between 160 and 360 females laying per year (Ottenwalder, 1987b). A further survey in 1986/87 produced an "order of magnitude" estimate of 225 C. mydas (Ottenwalder, 1987b).

Trends in nesting numbers Ottenwalder (1987b) stated that the decline of turtle populations, caused principally by the alarming rate of exploitation, was evident to most fishermen. It seems very likely that present population levels are only a small fraction of those in pre-Columbian times. Peters (1962) refers to late 15th and early 16th century accounts of the island of Hispaniola which talk of enormous numbers of turtles present, and particularly of mass nesting on the island of Alta Vela (Alto Velo) off the south-west coast near Cabo Beata in what is now the Dominican Republic.

It is not certain if the species involved were Hawksbills or Green Turtles, or both. References (cited in Parsons, 1962) by the Italian Cuneo in 1495 to "tartuge .... optime al mangiare" (best or ideal for eating) may be taken to imply that the turtles he was writing of were C. mydas, as this is the species whose meat is regarded as most palatable; the Hawksbill is generally, but by no means universally, regarded as an undesirable food item, even by those who eat other species of marine turtle. However in some, admittedly limited, areas (in the Caribbean most notably on Cayman Brac), the Hawksbill is actually preferred as a source of meat to the Green and it is conceivable that this pertained in Hispaniola at that time.

With respect to Alta Vela, Ottenwalder (1981) reports that Eretmochelys "still nests" there in undetermined although evidently low numbers; he makes no reference to any recent records of C. mydas.

Nesting season July to December, with most nesting in August and September and a single record of a pair mating in June (Ottenwalder, 1981).

Foraging sites There are relatively widespread areas of seagrass beds and coral reefs on the 8500 sq. km continental shelf around the country (Carr et al., 1982; Wells, 1988a) and Ottenwalder (1981) noted that many of the turtles recorded around the Dominican Republic were juveniles or sub-adults, indicating that there were significant foraging sites in these waters for Hawksbills, Green Turtles and Loggerheads (see also "Migration" below).

Migration Dominican Republic waters appear to serve as a significant foraging ground for the Green Turtles which nest on Aves Island c. 200 km west of Guadeloupe; of the 19 international tag returns (as of 1981) from females tagged while nesting on Aves, "most" have come from the Dominican Republic (see VENEZUELA). There have also been several recoveries of Green Turtles tagged at Tortuguero (see COSTA RICA).

Table 52. Estimated 1980 nesting populations in the Dominican Republic (Ottenwalder, 1981).

PROVINCE Coastal Region	*E. imbricata*	*C. mydas*
MONTECRISTI		
Cayos Siete Hermanos	5-15	1-3
P. Juan Bolaños - I. Cabras	?	?
PUERTO PLATA		
La Ensenada - P. Rusia	6-14	4-10
P. Castillo - C. Isabela	8-15	5-10
Sosua - Boca del Yásica	15-30	10-30
ESPAILLAT		
P. de Orí	?	-
MARIA TRINIDAD SANCHEZ		
Boba - Nagua	8-10	10-15
Nagua - Gran Estero	10-20	15-30
SAMANA		
B. del Estero - Terrenas	10-20	5-15
Terrenas - C. Samaná	10-40	10-30
El Francés - C. Levantado	3-6	?
LA ALTAGRACIA		
P. Nisibón - B. del Maimón	10-40	10-20
B. del Maimón - B. del Anamuza	12-30	10-15
Macao - Cabeza de Toro	20-40	20-30
C. Engaño - P. del Algibe	10-20	5-10
Isla Saona - B. del Chavón	10-15	5-10
LA ROMANA		
B. del Chavón - B. del Cumayasa	No available information	
Isla Catalina	5-10	1-5
SAN PEDRO de MACORIS		
B. del Cumayasa - P. Caribe	10-20	5-10
SAN CRISTOBAL		
Nigua - P. Palenque	1-5	1-2
PERAVIA		
Boca del Nizao - B. Las Calderas	10-25	5-20
AZUA		
Palmar de Ocoa - Monte Río	2-10	3-5
BARAHONA		
P. Martín García - Juan Esteban	15-30	5-10
Los Arroyos - Enriquillo	10-25	5-15
PEDERNALES		
P. San Luis - C. Beata	10-20	10-30
C. Beata - C. Falso (+ I. Beata)	30-110	10-20
C. Falso - Pedernales	10-30	5-15
	240-600	160-360
Approximate total	420	260

POPULATION: Eretmochelys imbricata

Nesting sites Nesting is widely dispersed along the coast, though possibly concentrated in the south-west (see Table 52).

Nesting numbers Estimates for 1981 are given in Table 52; estimated total population was between 240 and 600 females laying per year (Ottenwalder, 1981). A further survey in 1986/87 produced an "order of magnitude" estimate of 310 females (Ottenwalder, 1987b).

Trends in nesting numbers Ottenwalder (1981; 1987b) stated that the population was decreasing. See C. mydas account above for discussion of possible original population levels.

Nesting season Nesting has been recorded from May to December with most from August to October; Ottenwalder (1981) considered it possible that nesting occurred year round.

Foraging sites There are evidently widespread Hawksbill foraging sites around the coastline (see C. mydas above).

THREATS

The principal threat appears to be exploitation of turtles and their eggs. The incidental take is thought to represent an insignificant fraction of the total take (Ottenwalder, 1987b). Wells (1988a) notes that human activities have had a noticeable impact on the coastline of the country, resulting from dredging, pollution and coastal development. Ottenwalder (1987b) noted that nesting habitat was being destroyed at an alarming rate by (in order of importance) toursim, sand extraction and agricultural development. Tourism is given high priority by the Government, which has allocated seven of the best nesting areas as development zones.

EXPLOITATION

Commodity Carr et al. (1982) note that eggs are taken and nesting turtles regularly killed. Hawksbills are reportedly actively hunted for their shells and are frequently taken by divers with spearguns. Turtle meat is evidently consumed and Carr et al. (1982) noted stuffed Green Turtles and Loggerheads ranging from juvenile to adult size being offered for sale.

Hunting intensity Indications are that hunting is fairly intense. Ottenwalder (1987b) reported that turtles are generally caught whenever they are seen, indicating an intense level of exploitation. Official fisheries landing statistics are given in Table 53. These refer to sea turtle meat reported as "Carey" and "Tortuga" but Ottenwalder cautioned that "carey" is often used indiscriminately for sea turtles. He further asserted that the official figures do not include turtles killed on the nesting beaches and in remote areas. The laws regarding turtle capture are apparently widely disregarded. Interviews with fishermen suggest that they may capture one turtle every one to three weeks, but the total harvest for the year is estimated to be 1000-2000 turtles, of which 70% are thought to be C. mydas and E. imbricata.

Hunting methods Turtles are taken with a variety of nets, with boathooks, harpoons, spearguns and by turning females on nesting beaches

Table 53. Officially recorded landings of marine turtles in the Dominican Republic, 1967-86 (Ottenwalder, 1987b). * The total of monthly harvests for 1980 (also quoted by Ottenwalder, 1987b) gives 190172 kg. n.a. = not available.

Year	kg	Year	kg
1967	11428	1977	47000
1968	16127	1978	129000
1969	4609	1979	94180
1970	2942	1980	122578*
1971	329	1981	136900
1972	n.a	1982	51704
1973	n.a.	1983	98571
1974	5000	1984	51970
1975	66000	1985	44960
1976	45000	1986	41768

(Ottenwalder, 1981). There are references to the use of remoras by the indigenous indians. Currently the most common method is the use of spearguns by divers. Breeding males are taken off the nesting beaches by using "folas" - nets with a wooden turtle decoy (Ottenwalder, 1987b).

Domestic trade Carr et al. (1982) noted that tortoiseshell products and stuffed turtles (see above) were offered for sale in the Dominican Republic. Incháustegui (1984) quoted a 1983 value of 98.00 Pesos (1 Peso = US$1) a kg for tortoiseshell. The price of meat was said to have increased from RD$1-2.50 a lb in 1980 to RD$2.50-7 in 1986. Eggs are popular and fetch RD$0.50-1.50 each in the large cities, as is turtle oil which is used locally in cosmetics. Small turtles are stuffed and sold as curios, fetching RD$30-300. Larger animals fetch up to RD$1500, but more often the scutes are removed and sold separately. Fishermen are paid RD$75-90 a lb, but RD$150 can be obtained in the market in Santo Domingo (Ottenwalder 1987b).

Table 54. Exports of turtle products (in kg) from the Dominican Republic from official sources (Centro Dominicano de Promocion de Exportaciones, CEDOPEX) cited by Ottenwalder (1987b).

Year	1974	'75	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86
"Carey"	-	4634	3853	7099	-	1554	2858	3426	4294	651	-	454	1193
Oil	3694	-	-	100	-	-	-	-	-	-	-	-	-
Meat	-	-	-	-	-	-	-	-	-	146	8	-	-

International trade

Official statistics for the export of turtle products from the Dominican Republic are given in Table 54. There is no record of any export of tortoiseshell, and "carey" may therefore refer to whole turtles, to distinguish it from "carne de tortuga".

Most of the "carey" was exported to Puerto Rico, although between 1979 and 1983, 1519 kg went to Guadeloupe, 6332 kg to Martinique, and 988 kg to France, with 40 kg to St Maarten in 1982.

All of the oil was exported to the USA, as was 8 kg of meat in 1984. The remainder of the meat went to France and Martinique. Although the export of raw shell has been illegal since 1967, a measure to protect the local artisans, Ottenwalder (1987b) revealed that some tortoiseshell has been exported illicitly to Amsterdam. Further evidence of shell exports comes from the Japanese Customs statistics (Table 55) which show that 4366 kg were imported from Dominican Republic from 1972 to 1986. This does not represent a major source of shell for Japan and supports Ottenwalder's (1987b) assertion that most of the shell caught is used locally. He further claimed that in the last ten years, about 60-70% of the shell used had been imported from St Maarten, Panama and the Bahamas.

Table 55. Imports of Turtle shell products to Japan from the Dominican Republic 1972-86 (kg) recorded in Japanese Customs statistics.

Year	1972	'73	'74	'75	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86
Bekko	62	4	11	31	113	507	-	219	534	357	872	248	636	203	569
Other	-	-	-	-	-	-	62	-	-	44	-	-	-	-	-

The Dominican Republic became a Party to CITES with effect from 17 March 1987. All transactions, bar two, of Green Turtles or Hawksbills or their products reported by CITES involving the Dominican Republic have been to the USA in the years 1980-84. The exceptions are one body of Chelonia mydas and four of Eretmochelys imbricata imported by Italy in 1985 and classified as for "educational" purposes.

Table 56. Summarised exports of turtle products (excluding eggs) from Dominican Republic to the USA as reported to CITES 1977-1985. No exports were recorded for the years 1977-1979 and 1985-86. A = declared as origin Dominican Republic. B = re-exports from Dominican Republic. Figures in parentheses indicate number of whole shells or bodies recorded; other figures indicate total number of items recorded.

		1980	1981	1982	1983	1984
C. mydas	A	15 (15)	16 (16)	44 (34)	26 (26)	9 (5)
	B			12 (8)		
E. imbricata	A	334 (15)	36 (6)	394 (5)	385 (5)	21 (2)
	B			96 (2)	10	
Cheloniidae	A		1 (1)	6 (1)	6 (6)	6
	B				1	8

All recorded imports (bar one) to the USA from 1982 onwards have been classified as illegal shipments, those from 1980-81 as "personal" or

"commercial". This appears merely to reflect a change in the reporting system of the USA rather than a change in the application of CITES regulations. These transactions are summarised in Table 56.

LEGISLATION

Decreto No. 600, 26 February 1975
Prohibits the capture within territorial waters of all sea turtles with a carapace length of less than 50 cm.

Decreto No. 1580, 20 August 1977
Establishes a requirement to obtain a permit to export turtle products.
Prohibits the collection or sale of turtle eggs at all times.
Prohibits the keeping or capture of E. imbricata during the months of May, July, September and October.

Decreto No. 314, October 1986.
Establishes minimum size limits for the capture and sale of turtles as follows:

Chelonia mydas	90 cm
Eretmochelys imbricata	71 cm
Dermochelys coriacea	152 cm
Caretta caretta	152 cm (fide Ottenwalder, 1987b)

The capture of all females nesting or out of the water is prohibited. [It appears that Decreto No. 600, 1975 has been superseded, but it is not clear whether or not No. 1580, 1977 is still in force].

Ottenwalder (1987b) pointed out that the export of unworked shell of E. imbricata had been illegal since 1967, but without stating what legislation was involved.

ECUADOR: MAINLAND

POPULATION: Chelonia mydas

Nesting sites The Green Turtle is known to nest in small numbers along much of the Ecuadorean coast, from just north of Atacames in Esmeraldas in the north to Costa Rica Island near the Peruvian border in the south (Green and Ortiz-Crespo, 1981). Turtles have also been reported in the extreme north between Rocafuerte and the Colombian border, but as of 1981 no surveys had been carried out here (Green and Ortiz-Crespo, 1981). Principal nesting area is between Manta and Cojimíes in Manabí Province (Green and Ortiz-Crespo, 1981).

Nesting numbers No estimates are available, but nesting numbers are definitely low; Green and Ortiz-Crespo (1981) note that a 14 km stretch of beach between El Napo and Canoa in Manabí Province, known to be one of the more important nesting beaches, had a combined total of about ten turtles per night of all three nesting species (C. mydas, Eretmochelys and Dermochelys) during the peak of the season; C. mydas is the most abundant nesting species, and thus a good proportion of these are likely to have been this species.

Trends in nesting numbers There is no evidence that the Green Turtle has been an abundant nester on the mainland coast of Ecuador in the recent past; Parsons (1962) was told in 1956 that only stray Green Turtles came ashore to nest. They may, however, have been more abundant in the distant past; Parsons (1962) notes that archaeological work on the coast north of the Santa Elena peninsula in Guayas province revealed very large concentrations of turtle remains (species not given, but presumed to be C. mydas) in horizons dating to c. 4000 years ago.

Nesting season Reportedly (for all three nesting species) beginning in December and ending in April or May with a peak in February, this roughly coinciding with, though being shorter than, the Galápagos nesting season (Green and Ortiz-Crespo, 1981).

Migration At least part of the Galápagos population (see relevant account) is believed to migrate to and from Ecuadorean coastal waters (Green and Ortiz-Crespo, 1981). It is unclear if there are extensive feeding grounds here or if most turtles move through these waters to feed off the coast of Peru.

POPULATION: Eretmochelys imbricata

Nesting sites Nesting is known to occur in small numbers between Atacames in Esmeraldas Province in the north (at the same beach as C. mydas) and Ayampe in extreme southern Manabí Province (Green and Ortiz-Crespo, 1981). It may conceivably nest north of Atacames but no surveys have been carried out (Green and Ortiz-Crespo, 1981).

Nesting numbers No figures are available, though it is said to be rarer than C. mydas (q.v.).

Trends in nesting numbers No information, although there is no evidence that the species has been abundant in Ecuador in recent times.

THREATS

No information located, other than that concerning exploitation and incidental take (see below).

EXPLOITATION

Green and Ortiz-Crespo (1981) note that C. mydas is taken in very small numbers for local consumption and accidentally in shrimp and fishing nets all along its range, especially around Santa Rosa and La Libertad in Guayas Province; nesting females and eggs were taken whenever encountered on nesting beaches, although numbers were so low that they were not specifically searched for. Varnished carapaces are frequently sold in tourist areas such as Playas in Guayas Province (Green and Ortiz-Crespo, 1981).

Eretmochelys was reportedly taken less often than Chelonia, being rarer. Virtually all those taken were caught incidentally in shrimp and fishing nets; the meat was not eaten, although the eggs were taken on the rare occasions they were found. Varnished carapaces, plastrons and stuffed juveniles were found on sale in some tourist areas, such as Playas (Green and Ortiz-Crespo, 1981).

International trade CITES statistics indicate considerable quantities of C. mydas skins and skin or leather products exported from Ecuador, almost all to Italy, in the years 1979-83, amounting to several thousand skins annually. However, Green and Ortiz-Crespo (1981) state categorically that the only species of marine turtle commercially exploited on an international level in Ecuador is the Olive Ridley (Lepidochelys olivacea); they give detialed figures of production and export levels of this species for the years 1970-79. C. 130 000 kg of skins, representing c. 70 000 Olive Ridleys, were exported from Ecuador in the first six months of 1979 alone. Virtually none of this trade appears in CITES records under Lepidochelys; it can thus be assumed that the Ecuadorean trade reported in CITES as involving C. mydas in fact involves Lepidochelys. This may be because when Italy ratified CITES in 1979, it took a reservation on C. mydas but not on Lepidochelys olivacea. Thus to admit imports of L. olivacea would be to admit contravention of CITES.

ECUADOR: GALAPAGOS

POPULATION: Chelonia mydas

Nesting sites Nesting is known to occur on all major islands except Rábida, Pinzón, Genovesa and possibly Fernandina (Pritchard, 1975; Green, 1983). The most important beaches are Quinta Playa and Bahía Barahona on southern Isabela, Las Salinas on Baltra, Las Bachas on northern Santa Cruz and Espumilla on the north-western side of Santiago (Green, 1983). In the early 1970s Pritchard surveyed all major islands in the archipelago for evidence of nesting (Pritchard, 1975). There are reportedly c. 50 km of beaches on the archipelago, although the proportion known to be used by C. mydas is unclear; detailed studies to date have concentrated on only 6.8 km of beaches, although these are the ones most heavily used (Green, 1983).

Nesting numbers Green (1983) estimated that possibly 1200-3500 females nested annually in the archipelago, but noted that, in the absence of intensive surveys during the nesting season of the majority of beaches used (see above), such estimates were approximate at best. Data have been collected in the period 1976-82 for the major nesting beaches as follows: initial studies were concentrated on Quinta Playa (Isla Isabela) and Las Salinas (Isla Baltra); from 1979 the study was extended to: Bahía Barahona (Isla Isabela), Las Bachas (Isla Sta. Cruz) and Espumilla (Isla Santiago). In addition data were collected from Bartolomé (Isla Bartolomé) and la Picona (Isla Floreana) for one season each and sporadic observations were made in Bahía Borrero and Caleta Negra (Isla Sta. Cruz) and Playa Sardina (Isla San Cristóbal). Results are given in Table 57.

Table 57. <u>C. mydas</u> nesting on principal beaches in Galápagos 1975-83. Source: Hurtado (1984). * = Incomplete data. ** = Data excluded from calculations of % on each beach.

Nesting beach (Island)	1975	1976	1977	1978	1979	1980	1981	1982	1983	mean	%total	
Quinta Playa (Isabela)	39*	315	308	610	300	495	699	236*	37*	455	28.83	50.3
Bahía Barahona (Isabela)				181	120	288	288*	766	10*	339	21.48	
Las Salinas (Baltra)	48*	163	218	296	163	252	379	410	42*	269	17.05	31.6
Las Bachas (Santa Cruz)					115	243	50*	330		229	14.51	
Espumilla (Santiago)					85	123	223	114*		144	9.13	
Bartolomé (Bartolomé)	15*				44					44*	2.79	
La Picona (Floreana)								98		98*	6.21	
Playa Sardina (San Cristóbal)						7**						
Playas Caleta Negra (Santa Cruz)							7**					
Playa Bahía Borrero						3**						

Data in Table 57 indicate the number of individuals marked in each season, and thus the minimum number visiting nesting beaches in that season. Most important beaches were those on Isabela which accounted for 50.3% of nesting individuals and those on northern Santa Cruz (Las Bachas) and adjacent southern Baltra (Las Salinas) which accounted for a further 31.6%.

Studies in the period 1980-82 indicate a mean of 0.86 nests per female per season which is low compared with comparable figures for other well-studied populations (e.g. Hawaii and Tortuguero, Costa Rica); 37% mounted the nesting beach but did not nest, 45% nested once and the remainder nested 3-5 times. Observed remigration rate for the whole period (1975-83) was low (1.1%, or 88 of the total number of females marked during the study). Mean annual production of emerging nestlings has been calculated at c. 55 000 (Hurtado, 1984).

Hurtado notes some movement between nesting beaches: 9.8% of turtles observed more than once at nesting beaches during a season appeared at more than one beach while 12.5% of remigrating turtles were recorded at different beaches in subsequent seasons. Of the latter (n = 12), six involved movements between islands (treating Santa Cruz and Baltra as one island) (Hurtado, 1984). This total may be artificially elevated as it includes individuals which visited nesting beaches but did not nest (Hurtado, 1984).

Trends in nesting numbers No data are available to assess long-term trends. Data from post-1974 studies indicate considerable short term fluctuations in nesting numbers (see Table 57). These were similar on each of the beaches under study and appeared to be directly related to oceanographic conditions, with highest numbers in years when the Equatorial front was well-developed and marine productivity high (1978, 1982) and lowest in El Niño years (1975, 1976, 1983) (Hurtado, 1984).

Nesting season Laying starts around early December and lasts until the end of June with a peak in late February/March (Green, 1984b).

Foraging sites Green and Ortiz-Crespo (1981) note that the most important feeding grounds in Galápagos appear to be the beds of algae around the western islands of Isabela and Fernandina. There were indications that some individuals, particularly immatures and virgin females, tagged on the feeding grounds were present all year round and some females tagged on the nesting beaches were recaptured on the feeding grounds well outside the nesting season, implying that they too may have been year round residents in Galápagos. However the long-range recoveries (see below) from off the Central and South American Pacific mainland imply that at least part of the population is migratory.

Migration Green (1984a) discusses long-distance movements of Galápagos Green Turtles. Out of 5844 turtles tagged between 1970 and 1979, a total of 23 have been recovered away from the islands, along the Pacific coastline of South and Central America. This indicates that a proportion of the population, at least, migrates away from Galápagos, although the recovery rate is lower than for Green Turtles studied elsewhere. Of the total, ten were from Peru, five from Ecuador, one from Colombia, four from Panama and three from Costa Rica. Twenty of the recoveries were females and three males. One female was marked at Quinta Playa, recaptured off the coast of mainland Ecuador and subsequently recorded nesting again on Quinta Playa, one of the very few instances of two-way migration recorded anywhere (Green, 1983).

POPULATION: Eretmochelys imbricata

Eretmochelys is encountered occasionally in Galápagos but has never been shown to nest (Green and Ortiz-Crespo, 1981). Sightings have been made around the following islands: Fernandina, Isabela, Pinzon, Santiago, Santa Cruz, Baltra, Santa Fe, San Cristobal, and Floreana (Green and Ortiz-Crespo, 1981).

THREATS

The population on Galápagos appears to be relatively secure at present. Apart from a small amount of exploitation (see below), threats identified include nest-predation by feral pigs and by the scarabeid beetle Trox

<u>suberosus</u> and removal of sand from beaches for construction purposes. Pigs are a particularly serious problem at Espumilla on Santiago, where as a result of their activity hatching and emergence rates for nests were less than 2%; they are also a problem on the two main beaches on Isabela (Quinta Playa and Bahía Barahona). <u>T. suberosus</u> also appears to have considerable influence on emergence rates at Quinta Playa and has been found in nests at Bahía Barahona and Bartolomé on Santiago. It is not known how long the beetle has been present on the islands or whether it arrived naturally or was introduced by man, although Allgoewer (cited in Hurtado, 1984) considered it to be native.

Removal of sand from nesting beaches for construction is considered a possible long-term problem. Green (1983) stated that most of it came from beaches where very little nesting occurred; however, some came from Baltra, which island was an important nesting site, although from outside the boundaries of the National Park.

Hurtado (1984) also considers that long-term problems may arise from the increase of tourism and of uncontrolled urban growth of the town of Puerto Villamil on Isabela near the two most important nesting beaches. Concern has also been expressed that exploitation off mainland South and Central America will have adverse effect on the migratory part of the population (Green and Ortiz-Crespo, 1981; Hurtado, 1984), although at present there are inadequate data to draw any conclusions.

EXPLOITATION

Green and Ortiz-Crespo (1981) noted that there was very little current exploitation of Galápagos turtles. Only local inhabitants were allowed to fish for them, and then only on a subsistence basis, and not on nesting beaches which were all completely protected; they were rarely taken as their meat was not highly esteemed. However, military personnel on Baltra took up to six nesting females per season from beaches on that island; Hurtado (1984) noted that recently neonates had also been collected as souvenirs.

Exploitation in the past has been heavier. In the years 1971 and 1972 the Japanese refrigerator ship "Chicuzen Marou" collected between 1000 and 10 000 turtles (young, sub-adults and adults of both sexes) from the archipelago; the effect of this on the population is not known. Parsons (1962) gives an account of the harvesting of sea turtles for meat by visiting ships in the 19th century and earlier. He notes that in general land tortoises (<u>Geochelone elephantopus</u>) were preferred as a source of meat, although Green Turtles were sometimes taken as they were smaller and less bulky, and thus more easily transported onto the ships.

LEGISLATION

June 1981, the Subsecretaria and the Direccion General de Pesca of the Ministerio de Recursos Naturales y Energéticos banned the export of turtle skin.

Ley No. 74. Ley Forestal y de Conservacion de Areas Naturales y de Vida Silvestre. 14 August 1981.

This law governs the use of all Ecuadorean living resources, but excludes fish and marine species. Art. 47 prohibits the export of all native wildlife and their products except for scientific purposes.

EGYPT: MEDITERRANEAN

POPULATION

According to Sella (1982: Fig. 1) scattered sea turtle nesting occurs on the coast between Port Said and the Gaza area. The identity of the species involved is unknown but if any Green Turtles at all are present they are likely to be greatly outnumbered by Loggerheads.

EXPLOITATION

Coptic communities on the Mediterranean utilise "many" turtles (species uncertain, presumably C. caretta and/or C. mydas); the turtles are kept incapacitated in the market until required, when the throat is slit and the blood drunk to increase fertility (S. Goodman pers. comm., 10 June 1986).

EGYPT: RED SEA

POPULATION: Chelonia mydas

Nesting sites There are relatively few known C. mydas nest sites in the Egyptian Red Sea. There is reportedly some highly dispersed nesting around southern Sinai, also on adjacent Tiran Island, but the only known significant nest site in Sinai is located at Ras Shartib, south of Abu Rodeis, midway along the western coast of the peninsula on the Gulf of Suez (Sella, 1982). Nesting records are still more sparse in the Red Sea proper; probable nests of C. mydas have been recorded on Baruda Island, Siyal (Hamata) Island, Ras Banas, and on St John's Island (Zabarga), which may be a small Green Turtle rookery; these sites are situated in the southern third of Egypt's section of the Red Sea (Frazier and Salas, 1984).

Nesting numbers Some 40 nests (or apparent nests) were found at Ras Shartib in October 1967, and 37 nests on a 200-m stretch at the same site in July-September 1969, with an additional 30 nests recorded in an aerial survey at the end of September (Sella, 1982). Around 60 nests were said to be made on St John's in July, probably a mixture of Green Turtles and Hawksbills (Frazier and Salas, 1984). The Green Turtle is uncommon in Egyptian waters, and despite the ready availability of suitable nesting habitat, probably fewer than 100 females nest annually in the country (Frazier and Salas, 1984).

Trends in nesting numbers No direct information is available. Considering the evidence for high levels of trade in turtle products in the past, and the present extent of habitat disturbance in the Red Sea, it is possible that sea turtle populations have declined.

Nesting season Nests have been recorded between July and October.

Foraging sites The species is likely to range through much of the Egyptian Red Sea but suitable feeding grounds of algae or seagrasses are relatively restricted in extent (Frazier and Salas, 1984).

POPULATION: Eretmochelys imbricata

Nesting sites Signs of nesting have been recorded at many sites between Gubal el Kebir, at the southern end of the Gulf of Suez and Ras Banas, toward the south of Egypt's Red Sea coast (Frazier and Salas, 1984). Some mainland nesting occurs, but much less commonly than on islands, which include Gubal el Kebir, Baruda, and Siyal, Amalawaya and Mahabis in the Hamata group. There is said to be some nesting on islands in the Gulf of Aqaba, Shadwan (at the mouth of the Gulf of Suez), and on islands stretching south from Ras Banas to the Sudan border including St John's (Frazier and Salas, 1984) . In the latter area, the Siyal islands (notably Gezira Siyal Kebir) and the Rawabel islands, there are turtle nesting sites almost certainly used by Hawksbills (Goodman, 1985) (the Siyal and Rawabal islands are within the Sudan Government Administration Area, although part of Egyptian territory (Goodman, 1985).

Nesting numbers "Very provisional estimates" made on the basis of observed nesting signs suggest that 100 females a year may use Gubal el Kebir and nearby islands, 50 a year in the Baruda and Hamata groups, and 50 on Ras Banas (Frazier and Salas, 1984). Four or five females are reported to nest nightly in April-May on Gezira Siyal Kebir (Goodman, 1985). There appear to be fewer than 200 females nesting each season in the area surveyed by Frazier and Salas, but including other reputed nesting sites (eg. Shadwan) and nesting on Tiran and Shanafir, there could be up to 500 Hawksbill nesting annually in Egyptian territory (Frazier and Salas, 1984). The Hawksbill is certainly far more abundant in Egypt than other sea turtle species, and a nesting population of 200-500 is relatively large on a world scale (Frazier and Salas, 1984).

Trends in nesting numbers Frazier and Salas (1984) suggested that sea turtle populations in Egypt are likely to have declined in numbers, but acknowledge that this cannot be substantiated.

Nesting season Nesting appears to take place between April and July (Frazier and Salas, 1984).

Foraging sites Suitable coral reef feeding habitat is vast in extent and rich in species (Frazier and Salas, 1984).

THREATS

Habitat disturbances, notably oil pollution and underwater explosions, are probably the major current threat to turtle population in Egypt. Oil pollution, in the form of spills and tar balls from tanker washing, is widespread. Two dead beached Hawksbills found in a recent survey were oil-covered; this is suspected to indicate a major oil pollution incident (Frazier and Salas, 1984). Underwater explosions, carried out during seismic oil-survey work or fishing, are certain to have damaged coral reef and other habitats, and are suspected to cause some turtle mortality.

EXPLOITATION

Commodities Both C. mydas and E. imbricata are exploited locally for eggs and meat: egg collection may be widespread and some fishermen claim regularly to eat turtle meat, including Hawksbill, which is reported to be occasionally poisonous in the area. Turtle carapaces are sold as tourist

curios, but not, apparently, in large numbers. Some Bishari people make shields from the carapaces of E. imbricata (Frazier and Salas, 1984).

Hunting intensity Current levels of exploitation for eggs and meat do not seem to be heavy. Sella (1982) reported that both E. imbricata and C. mydas were occasionally caught in Sinai, and that the eggs of C. mydas were collected opportunistically by the sparse Bedouin population in the region. The total incidental catch per year probably does not exceed 270 turtles (C. Bean, cited in Frazier and Salas, 1984), about 160 being taken by trawlers and 56 in nylon gill nets.

Hunting methods There is no documentation of organised fishing for turtles, although they are reported to be "eagerly sought on land and in the sea". There is a significant incidental catch of turtles in gill nets and, particularly, trawls (Frazier and Salas, 1984).

Historical trends Exploitation of Hawksbill Turtles for shell has a long history in Egypt, dating back to predynastic times. The warehouses in Alexandria were said to be full of this commodity when they were taken by Julius Caesar (Parsons, 1972).

Domestic trade There is little attempt to trade specifically in Hawksbill shell; one informant had sold an entire carapace for the trivial sum of US$5, and claimed to catch only one or two Hawksbills a year (Frazier and Salas, 1984). Even if the animal is used for food the shell is rarely collected.

International trade It is by way of Egypt that the majority of tortoiseshell reached Rome, although much of it was brought by Arab traders from elsewhere in the Indian Ocean (Parsons, 1972). In the 1930s, about 2000 Green Turtles a year were imported from the Mediterranean coast of Palestine to Egypt, whence they probably went to supply the British market (Sella, 1982). There is no evidence for a continuing international trade in tortoiseshell or turtle meat. CITES Annual Reports indicate imports of one shell of C. mydas from Egypt to Italy in 1985 and one to the UK in 1983.

LEGISLATION

There are believed to be no regulations prohibiting the capture of sea turtles in Egypt, except those relating to protected areas.

POPULATION: Chelonia mydas and Eretmochelys imbricata

N.B. Information from Cornelius (1981) is generalised; four species of turtles nest in El Salvador (Lepidochelys olivacea, Dermochelys coriacea, Eretmochelys imbricata and Chelonia mydas), of which Lepidochelys is reportedly the most abundant and Eretmochelys the rarest.

Nesting sites Cornelius (1981) notes that dispersed nesting of turtles occurs on all sandy beaches.

Trends in nesting numbers Reports cited in 1981 indicated that turtle nesting in general had decreased abruptly in recent years (Cornelius, 1981).

Nesting season Given for turtles in general as July-December (Cornelius, 1981).

THREATS

Cornelius (1981) notes that El Salvador appears to be the only country in Middle America where beach destruction and alteration are serious threats to nesting habitat, principally through construction of tourist facilities near the high tide line causing beach erosion, and general pollution of the shoreline. Considerable numbers of turtles, apparently mostly Lepidochelys, are drowned in nets of the shrimp fleet which operates in nearshore waters from Estero Jaltapeque to the mouth of the Gulf of Fonseca (Cornelius, 1981).

EXPLOITATION

Exploitation of adult turtles is apparently very low, although there is a small craft industry in tortoiseshell. Cornelius describes a well organised domestic egg trade. Some attempt has been made to control this - Decree 427 of December 1977 prohibited the hunting, selling, buying, exporting and consumption of all marine turtles and their eggs for the period of the following year. During this time fewer eggs than previously were openly sold in the markets, although poaching on nesting beaches was apparently uninterrupted and bars and restaurants continued selling eggs with few restrictions. Zelaya (cited in Cornelius, 1981) states that 18 956 eggs were sold in three markets during September-December 1978 at around $2.50-3.00 per dozen, the high price being indicative of their scarcity.

International trade El Salvador is not a signatory of CITES. All CITES reported trade with El Salvador has been reported by the USA and appears to be insignificant compared with domestic production. From 1980 to 1984 some 2291 turtle eggs were recorded as imported to the USA with origin El Salvador. Of these, 861 were stated to be Chelonia mydas, 1265 Eretmochelys imbricata and the remainder unspecified Cheloniidae. Just over 19% were seized as illegal imports. Thirty-one individuals and shells of Chelonia mydas and eight pieces of Eretmochelys were exported to the USA in 1980; all these were recorded as personal effects.

LEGISLATION

Decreto No. 427, 22 December 1977.
All hunting and export of sea turtles and their eggs was prohibited for a one year period beginning 9 January 1978.

EQUATORIAL GUINEA: BIOKO

POPULATION: *Chelonia mydas*

Nesting sites Almost all turtle nesting on Bioko (Fernando Poo), including by *C. mydas*, occurs along the southern coast of the island, along some 20 km of beach. The village of Ureka is the only settlement on the south coast (Butynski and Koster, 1986).

Nesting numbers No nesting surveys have been carried out, but the fact that 50-100 turtles can be harvested daily on beaches in the vicinity of Ureka during the peak nesting season (T. Butynski *in litt.* to K. Bjorndal, 20 April 1986), suggests that a very substantial population nests in southern Bioko. Whilst four species are reported to use these beaches, *C. mydas* and *E. imbricata* appear to be the main species involved (T. Butynski *in litt.*, 3 November 1986), and on this basis presumably will jointly comprise the main turtle harvest. The proportion of each is unknown but the former is likely to be the most abundant. Local opinion, reported by Butynski and Koster (1986) is that the beaches on southern Bioko support the most dense turtle nesting in West Africa. If the harvest figure is a good measure of the nesting turtle population, the Bioko beaches, on present information, may support the largest *C. mydas* nesting population anywhere on the continent's entire western seaboard.

Trends in nesting numbers Inhabitants of Ureka reported to Butynski (*in litt.* to K. Bjorndal, 20 April 1986) that *C. mydas* nesting numbers are declining: whereas 200-300 could be harvested daily during peak nesting periods in the early 1940s, the maximum now is 50-100.

Nesting season Most nesting occurs between September and February, with a peak in October-December (T. Butynski *in litt.*, 3 November 1986).

POPULATION: *Eretmochelys imbricata*

Nesting sites Almost all turtle nesting on Bioko (Fernando Poo), including by *E. imbricata*, occurs on some 20 km of beach along the southern coast of the island. The village of Ureka is the only settlement on the south coast (Butynski and Koster, 1986).

Nesting numbers No nest survey information is available. A significant proportion of the 50-100 turtles that reportedly can be harvested daily in the peak nesting season (T. Butynski *in litt.* to K. Bjorndal, 20 April 1986) appears likely to be *E. imbricata* (since this species and *C. mydas* seem to be the most common turtles in the area).

Trends in nesting numbers Local informants at Ureka stated that *E. imbricata* now appears in far lower numbers than in the early 1940s (T. Butynski *in litt.* to K. Bjorndal, 20 April 1986).

Nesting season All four turtle species nesting on Bioko appear to do so September-February, with a peak in October-December (T. Butynski *in litt.*, 3 November 1986).

EXPLOITATION

Commodity *C. mydas* and *E. imbricata* are regularly exploited for meat and eggs, the main centre of operations being Ureka, the only village on the south coast. Turtles are said to be an important source of protein and cash for the villagers. Hawksbill shell is also sold (Butynski and Koster, 1986).

Hunting intensity Exploitation is running at a high level: the locals claim that 50% of the turtles coming ashore to nest along the 10-15 km beach near Ureka are killed. At the height of the season, 50 or more turtles can be killed in a single night, and the total annual harvest of all species is believed to be 2000-2500. Eggs are eagerly sought, and it is probable that few survive to hatch (Butynski and Koster, 1986).

Hunting methods Butynski and Koster (1986) implied that the turtle harvest is almost entirely of nesting females on the beaches.

Historical trends Turtles were said to have been heavily exploited by the Russians in the 1970s (Butynski and Koster, 1986). In the early 1940s, about 200-300 *C. mydas* were said to be killed each night at the peak of the nesting season, while nowadays the peak is about 50-100 a night (T. Butynski *in litt.* to K. Bjorndal, 20 April 1986).

FAO statistics show an estimated harvest of "turtles not elsewhere specified" of 100 t a year from 1968 to 1981. The harvest was said to be 80, 90 and 150 t in 1982, 1983 and 1984, respectively.

Domestic trade Turtles are said to be worth US$45-90 each to the people who kill them. The total value of the resource is worth US$135 000 a year in meat alone (Butynski and Koster, 1986). The turtles are said to be taken by boat to Malambo, the capital of Bioko, where the meat is much appreciated (B. Adama *in litt.*, 10 September 1984). Most of the eggs are consumed locally and are not sold (Butynski and Koster, 1986).

International trade Equatorial Guinea is not a Party to CITES. There is no record of any trade in sea turtles with Equatorial Guinea recorded in the CITES Annual Reports.

LEGISLATION

As far as is known, turtles are not protected in Equatorial Guinea.

EQUATORIAL GUINEA: MAINLAND

No information is available on turtle nesting or exploitation in the mainland portion of Equatorial Guinea.

POPULATION: __Chelonia mydas__, __Eretmochelys imbricata__

Both Green Turtles and Hawksbills have been reported from the Dahlak Archipelago region, off the Eritrea coast (Hoofien and Yaron, 1964; Urban, 1970). Green Turtles are said to nest wherever suitable beaches occur (Anon., 1972). Recorded localities include: Sciumma Island, 20 March 1969, one female nesting, signs of two other nests seen; Assarca Island (10 km east of Sciumma), 21 March, signs of at least three fresh nests; Ito Umm Narus (15 km south of Sciumma), 22 March, ten fresh and two older nests (Urban, 1970). A Hawksbill skeleton was found on Entedebir (Hoofien and Yaron, 1964). The Dahlak Archipelago comprises several hundred islands, many uninhabited, spread over some 200 sq. km; if the level of nesting noted by Urban occurs widely, the group as a whole would be a moderately important nesting area. No information is available for the mainland. One female __C. mydas__ tagged in Oman was recovered at Assab in the Ethiopian Red Sea (Ross and Barwani, 1982).

EXPLOITATION

Commodity Any exploitation appears likely to involve mainly eggs and meat, though these are indication of an export trade in shell.

Hunting intensity Green Turtles have reportedly been heavily exploited on most of the more accessible Dahlak Islands (Anon., 1972).

Domestic trade Hoofien and Yaron (1964) reported that they had purchased two Green Turtle carapaces and a live Hawksbill from fishermen on Nakara (= Nocra).

International trade The ancient port of Adulis in Abyssinia was said by Parsons (1972) to have featured prominently in the ancient trade routes by which tortoiseshell reached Rome from sources in the Indian Ocean. There are no records in CITES Annual Reports of trade in turtle products with Ethiopia which is not a Party to CITES. However, Japanese Customs statistics have recorded the import of bekko (shell of __E. imbricata__) from Ethiopia in a few years (Table 58).

Table 58. Imports of bekko from Ethiopia recorded in Japanese Customs statistics (kg). There were no other imports between 1950 and 1985.

1968	1970	1971	1972	1973	1974	1975	1986
420	573	453	286	500	400	500	427

LEGISLATION

Wildlife Conservation Regulation 1972 (19 January 1972).

Special permits are required for the hunting of all animals, including nests and eggs. The hunting of animals at night is prohibited. Export permits are required for all exports of animal products. These regulations appear to apply primarily to terrestrial animals, but they do include "all birds, fish and reptiles".

This region includes the states of Yap, Truk, Ponape and Kosrae, comprising the majority of the Caroline Islands (the exception being Palau). Most turtles in the region are C. mydas (McCoy, 1982).

POPULATION: Chelonia mydas

Nesting sites Turtles are seen occasionally around the main islands (Yap, Koror, Truk, Ponape, Kosrae) but nesting is largely restricted to small uninhabited islands, such as Oroluk, Pikelot, West Fayu, and Gaferut (McCoy, 1982). Pritchard (1982b) cited East Fayu as important for nesting by this species. Herring (1986) reported C. mydas nesting on several of the "outer islands" of Ponape State, including the atolls of Oroluk, Ngatik (formerly), Nukuoro, Mokil, Pingelap, and (species unconfirmed) on Kosrae Island (Kosrae State).

Nesting numbers On Oroluk, widely considered as one of the better "turtle islands" in the Carolines, McCoy's informants (1982) variously estimated that between 40 and 100 females nest in a year. This would represent only a small population. Local residents reported to Herring (1986) that only 50 nests were laid in April-October 1985 (see Table 59).

Table 59. Monthly C. mydas nesting reported on Oroluk atoll, 1985 (data from Herring, 1986).

April	May	June	July	August	Sept.	Oct.	Total nests
1	20	3	18	7	1	0	50

Local residents told Herring (1986) that there are around 30 nests a season on Nukuoro (both C. mydas and E. imbricata), and that "many" turtles (both species) nest on Mokil; Pritchard (1982b), however, stated that no nesting occurs on Mokil (although small C. mydas forage in Mokil lagoon). Pritchard (1982b) cites several minor or possible nesting islands. Nesting is sparse at best in Kosrae (Pritchard, 1982b). McCoy (1982) reported that "relatively large numbers" of turtles nest on two islets just outside Ulithi atoll, and "probably not very large numbers" on West Fayu and Pikelot. Pritchard (1982b) was told that six or seven nested nightly during the February-June season, and one to three nightly on Fananu and on islands of Murilo Atoll; Pritchard regarded the estimate given of around 30 turtles nesting nightly on Pikelot to be a distinct exaggeration, although around 20 may be turned on the beach during a stay of one or a few nights. On present information, which is incomplete, it seems unlikely that annual nesting numbers in the Federated States of Micronesia exceed a few hundred.

Trends in nesting numbers Pritchard (1982b) was informed that turtle numbers are decreasing on Pikelot, but remaining steady in the Hall Island-East Fayu area and in the Truk Lagoon area. On the other hand, Fuchs (cited by Johannes, 1986) received reports that turtle populations were lower in the 1970s than in the past, probably due to over-exploitation. Oroluk was uninhabited until the late 1960s; residents reported (Herring, 1986; McCoy, 1982) that large numbers of C. mydas and E. imbricata used to nest on the atoll but there had been a drastic decline in nesting by the former, and virtual cessation of nesting by the latter. Whereas Pritchard (1982b) was told (apparently in the 1970s) that 9-15 turtles (probably mainly C. mydas) nest nightly on Oroluk, and occasionally up to 20, only 50

were reported to nest in April-October 1985 (Herring, 1986). Turtles (both species) used to nest on Ngatik, but had not done so for the past few years (Herring, 1986). This decline is attributed to human population increase and increased hunting for turtles; to the extent that these factors operate elsewhere, similar declines would be expected to have occurred.

Nesting season The main nesting period is reportedly from May to September (Herring, 1986).

Foraging sites Suitable feeding grounds would appear to be widespread, but mainly occurring on high volcanic islands in the Caroline group, where turtles, both mature and immature, are seen. Atolls are generally without Thalassia or other seagrass, and only mature turtles are found there (M. McCoy in litt., 24 August 1988).

Migration There has only been one tag return to date from several dozen turtles tagged over the last ten years. A mature C. mydas, tagged at Oroluk in 1985, was returned from Taiwan in the South China Sea in early 1987 (M. McCoy in litt., 24 August 1988).

POPULATION: Eretmochelys imbricata

Nesting sites Few details are available of nesting sites or numbers. Herring (1986) reports nesting on Oroluk (formerly), Ngatik (formerly), Nukuoro, Kapingimarangi, Mokil, Pingelap, and possibly Kosrae. Pritchard (1982b) reported that this species nests on a number of barrier islands on the reef of Truk Lagoon (Holap, Tora, Ruac, Lap, Ushi, Onao, Tonelik, Pis, Alanenkobwe, Lemoil and Falalu) and on uninhabited islands in the Lower Mortlock group (the atolls of Etal, Lukunor, Satawan).

Nesting numbers Few details are available. The species appears generally to be less common than C. mydas (Pritchard, 1982b), and it may be inferred that nesting numbers are correspondingly lower. Pritchard was informed (1982b) that one or two might nest nightly on each beach in the Truk Lagoon area (in May-October), and that nesting was "casual" in the Lower Mortlocks. McCoy (1974) reported that Hawksbills "are extremely rare throughout the area". He was referring to Satawal in particular and, apparently, the central Carolines in general. No evidence was found of nesting on Satawal; only four were seen around Satawal in 1972, two of which were taken (McCoy, 1974). Informants of Herring (1986) reported that about ten females nest on Rugureru Island of Kapingimarangi Atoll, that "many" turtles (C. mydas and E. imbricata) nest on Mokil, and about 30 nests are made annually on Nikuoro (both species), although this is thought to be unlikely (M. McCoy in litt., 24 August 1988).

Trends in nesting numbers Information is sparse; Herring (1986) cites two atolls, Oroluk and Ngatik, where nesting formerly occurred (apparently in large numbers at Oroluk), and that turtles (probably this species) no longer nest on Hare Island in Kapingimarangi Atoll, due to an increase in the human population. According to Niering (1963, cited in Johannes, 1986), turtles had recently become rare in the Kapingimarangi area.

Nesting season According to Herring (1986) the main turtle nesting season in the region is May-September; it is not clear to what extent this applies specifically to E. imbricata.

Foraging sites Suitable foraging habitat appears to be widespread; no details are available.

EXPLOITATION

Commodity Turtle meat and eggs are widely eaten, but there are many traditional taboos attached to the killing, preparation and eating of the turtles, particularly in the Yap district. Hawksbill shell was formerly used for fish hooks and ornaments by the Trukese (Johannes, 1985).

Hunting intensity Pritchard (1982b) reported that rather few fishermen were operating in Truk Lagoon, but that a turtle could be obtained on demand. In the Ponape District, the local people at Oroluk Atoll were said to catch and eat a substantial proportion of the nesting turtles (Pritchard, 1982b). A stone holding-pen had been built to keep turtles to await the visiting Government ship which transported them for sale in Ponape. However this practice was stopped by the enforcement of the Endangered Species Act (Johannes, 1986).

Hunting methods McCoy (1974) provided descriptions of some of the techniques of turtle capture. Visits are often made to West Fayu to catch turtles mating in the lagoon, either by attaching hooks or by simply wrestling with the turtles and tying a rope to the flippers. Spearing is a common method at Truk (Pritchard, 1982b) and nets have been used at some islands (Johannes, 1986).

Historical trends The taboos associated with the eating of turtle meat have had an effect in limiting the exploitation. The consumption of eggs is not generally subject to the same restrictions. Many of the taboos were still operative in Yap in the 1970s. The introduction of outboard motors has greatly facilitated the visits to some of the distant islands (Johannes, 1986).

Domestic trade Pritchard (1982b) reported a small amount of inter-island trade in turtles for meat, and said that Hawksbill shell ornaments were sold to tourists at Truk.

International trade See under "PALAU".

LEGISLATION

Code of Federated States of Micronesia. Title 23, Section 105.

The taking of <u>E. imbricata</u> of lengths less than 27 inches (68.6 cm) and of <u>C. mydas</u> of less than 34 inches (86.4 cm) is prohibited.

Taking of any turtles during the periods 1 June-31 August and 1 December-31 January is prohibited.

Turtles may not be killed on shore, and their eggs may not be collected.

The USA Endangered Species Act (q.v.) used to apply to the Trust Territory, but there was a special exemption to allow a subsistence take of <u>C. mydas</u>. However, since November 1986 the Act no longer applies.

POPULATION: Chelonia mydas

Nesting sites With more than 330 islands in the group, about one-third uninhabited, sea turtle nesting is likely to be widespread. No comprehensive survey has been carried out. Bustard (1970) reported that nesting occurs on certain islands off eastern Vanua Levu, including Taveuni (species undetermined), Laucala, Nanuku Levu and Nanuku Lailai. Hirth (1971) reported that nesting (species undetermined) is said to occur in the southern Lau group, Tavarua and Namoto. Hirth (1971) suggests that the Yasawa Islands, Mamanutha Islands, and the Lau group are likely to support greatest nesting numbers; none of the sites examined by, or reported to, Hirth appeared likely to hold large numbers of turtles (Hirth, 1971). No information is available for Rotuma.

Nesting numbers Very little information is available. Bustard (1970) noted that the two Nanuku islands were said to be the only nesting site in the Taveuni region with good numbers involved; Bustard found six old nests (mostly C. mydas) on Nanuku Levu and two old nests on Nanuku Lailai. While present information is very inadequate, it seems likely that only small numbers nest annually in Fiji.

Trends in nesting numbers No reliable comparative data are available. Bustard (1970) reports several sites where turtles were said to be less abundant than in previous years, or had ceased nesting altogether; this apparent widespread decline is attributed by Bustard to the avidity with which eggs and turtles are hunted for food.

Nesting season Most turtle nesting on Fiji appears likely to occur during the austral summer, with a peak around January (Bustard, 1970).

Foraging sites Seagrass pastures appear to be widespread in Fiji, with a notable area off the southern coast of Viti Levu (Hirth, 1971), and pastures off north-central Viti Levu are cited as a foraging ground sometimes hunted over by fishermen from Malaku Island.

Migration No information is available on movements of Fijian nesters, but C. mydas tagged in French Polynesia have been recaptured in Fijian waters (see FRENCH POLYNESIA account).

POPULATION: Eretmochelys imbricata

Nesting sites With more than 330 islands in the group, about one-third uninhabited, sea turtle nesting is likely to be widespread. Bustard (1970) recorded nesting by this species on Laucala, Matagi and Nanuku Lailai, all near Taveuni, off the east coast of Vanua Levu. Hirth (1971) cited a report that E. imbricata is fairly common inside the northern loop of Great Astrolabe Reef in Kadavu, but it is uncertain whether this species is responsible for the evident signs of nesting there; the species is reported to nest in the southern Lau group. No information is available for Rotuma.

Nesting numbers Very little information is available. Bustard (1970) recorded 18 old E. imbricata nests on 12 January on Nanuku Lailai and two on Nanuku Levu; these islands were said locally to be the best turtle nesting grounds in the Taveuni region. While present data are very sparse, it seems likely that only small numbers nest annually in Fiji.

Trends in nesting numbers No reliable comparative data are available. Bustard (1970) reported several sites where turtles were said to be less abundant than in previous years, or had ceased nesting altogether; this apparent widespread decline is attributed by Bustard to the avidity with which eggs and turtles are hunted.

Nesting season Most turtle nesting on Fiji appears likely to occur during the austral summer, with a peak around January (Bustard, 1970).

Foraging sites No detailed information is available, but suitable reef areas appear to be widespread in the group.

THREATS

Bustard (1970) stresses that local exploitation of eggs and adults for food is intense, and coupled with technological advances (such as the use of outboard motors), has led to over-exploitation.

EXPLOITATION

Commodity Turtle meat has long been a delicacy of the Fijians and is also in great demand in tourist restaurants. Eggs are also collected, and there is a major shell carving industry (Bustard, 1970). Both C. mydas and E. imbricata shell are used (Hirth, 1971).

Hunting intensity Turtles are caught in large numbers around the islands, and the "local consumption" of turtle meat is recorded in Fisheries statistics supplied by the Fisheries Division of the Ministry of Primary Industries (G. Nath in litt., 16 September 1986). These are given in Table 60, along with fisheries statistics from the FAO, which specify both C. mydas and other species of turtles. The annual totals between 1981 and 1984 show little correlation, the FAO figures being appreciably higher. It is possible that the FAO statistics include the weight of E. imbricata caught which may not be included in the figures for meat for "local consumption" supplied by the Ministry of Primary Industries.

Table 60. Reported harvests (in tonnes) of turtles in Fiji. 1 = "local consumption" of turtle meat is recorded in Fisheries statistics supplied by the Fisheries Division of the Ministry of Primary Industries (MPI) (G. Nath in litt., 16 September 1986). 2 = FAO catch statistics.

Year	74	75	76	77	78	79	80	81	82	83	84	85
1. Fisheries Division (M.P.I.)												
Turtles								13	24	34	21	12
2. FAO Statistics												
C. mydas	45	36	42	40	13	10	8	10	30	18	30	
Other Turtles	*	*	1	2	3	1	2	2	1	0	64	

* 0-0.5 t

There is little qualitative information on hunting levels since 1971. Bustard (1970) reported that hunting in 1969 was intense and that turtles were killed as soon as they came up to lay, in spite of protective legislation. Hirth (1971) estimated that off the north coast of Viti Levu, about 80 C. mydas were caught in October alone. Pritchard (1979) indicated that the laws were still being flouted and that the hunting continued.

Hunting methods The major methods of turtle capture are by spear and nets. Legislation defines the type of spear that may be used and stipulates that it must be furnished with a barb (Hirth, 1971). Many turtles are killed on the nesting beaches and if the hunters notice a nest that they have missed they return about a fortnight later to look for the returning female (Bustard, 1970).

Historical trends Bustard (1970) considered that the hunting of turtles and their eggs had evidently been carried on "in some degree for hundreds of years"; however he thought that the greater mobility afforded by outboard motors, the growing human population and the demand for meat from tourist hotels would inevitably have increased the hunting pressure.

Domestic trade In 1969, Green Turtle meat sold in the market for 30 c a lb (66 c a kg), and appeared on the menu in first-class hotels. Hawksbill shell jewellery and curios were on sale in Suva and in the market, varying in price from 30 c for a spoon to $30 for a whole carapace. The wholesale price of Hawksbill and Green Turtle shell was $5 and $1.85 a lb ($11 and $4.07 a kg) respectively (Hirth, 1971).

International trade The export of turtle meat has been prohibited since 1965 (G. Nath in litt., 16 September 1986). Hirth (1971) reported that, prior to 1969, a total of 500 lbs (227 kg) of turtle shell could be exported annually, but that on 10 September 1969, all export of shell was banned except under special permit. Fijian Customs statistics recorded the export of raw tortoiseshell up until 1980, and these figures (Table 61) indicate that substantial exports continued until 1980, far in excess even of the 227-kg quota mentioned by Hirth (1971). The Fisheries Division of the Ministry of Primary Industries supplied figures of the exports of turtle shell from 1981 to 1985 which amounted to 50 kg, 76 kg, 93 kg, 56 kg and 505 kg for the five years respectively (G. Nath in litt., 16 September 1986). Exports for 1986 and 1987 were 293 kg and 1688 kg (Fiji Bureau of Statistics, quoted by T. Daly in litt., 21 July 1988). Some of the shell exported is evidently of C. mydas, as Hirth (1971) noted that only 64% of the 302 lb (137 kg) of turtle shell exported in 1969 and 29% of the 593 lb (270 kg) exported in 1968 was the shell of E. imbricata. Japanese Customs statistics record the import of raw tortoiseshell from Fiji, and the quantities are shown in Table 64. Almost all was bekko (E. imbricata) but 101 kg of other tortoiseshell was imported in 1972. The Japanese figures indicate that the figures supplied by the Ministry of Primary Industries may have significantly under-estimated the true export trade.

Fiji also has substantial trade in worked tortoiseshell items, which are recorded in Fijian Customs statistics; imports are shown in Table 62 and exports in Table 63. The quantities in these tables are the values in Fijian dollars; so it is difficult to relate these to the amount of turtle shell. However there is clearly a large net import. Some of the exports reported may be re-exports of previously imported material, but some is probably manufactured in the country. As no imports of raw tortoiseshell are reported it must be assumed that the raw material derives from turtles caught in the islands.

The most significant, apparently commercial, trade was the import to France of 60 kg of E. imbricata shell from Fiji in 1985.

Fiji is not a Party to CITES, but CITES Annual Reports indicate that it is a fairly important source of tourist possessions made from tortoiseshell. Between 1980 and 1984, a total of 29 items of Cheloniidae, 68 of C. mydas and 71 of E. imbricata were reported as imports to the USA and Australia.

LEGISLATION

Fisheries Act (1 January 1942).

No person may harpoon a turtle unless the harpoon has at least one barb which projects no less than 3/8 inch (9.5 mm) from the surface of the shaft, measured at right angles to the shaft.
Amended by Regulations 8 June 1966.

Turtle eggs may not be dug up, used or destroyed.
No turtle with a shell length of less than 18 inches (457 mm) may be killed, taken or molested.
No turtle may be killed, taken or molested during the months of January, February, November and December.

Table 61. Destination of exports of "unworked tortoiseshell", Category 291-161, reported in Fijian Customs Statistics (kg). Statistics before 1979 were taken from Wells (1979).

Destination	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Australia	0	0	7111	0	0	0	0	60	0	0	0
Canada	0	0	0	0	0	0	0	0	150	0	0
FR Germany	0	0	0	0	0	0	10159	0	9144	0	0
Italy	0	0	0	0	0	0	20317	0	0	0	0
Japan	2032	1016	50794	183873	61996	8279	12952	0	16803	111	152
Mexico	0	0	0	0	0	813	0	0	0	0	0
N Caledonia	0	0	0	0	0	0	0	302	0	0	0
N Hebrides	0	0	0	0	0	0	0	0	102	0	0
Spain	0	0	0	0	0	0	10159	0	9144	0	0
Switzerland	0	0	0	0	0	2031	0	0	0	0	0
UK	0	0	0	0	59987	27987	0	0	0	0	0
Total	2032	1016	57905	183873	121983	39110	53587	362	35343	111	152

Table 62. Source of imports of "worked tortoiseshell and articles of tortoiseshell, etc", Category 899-100, reported in Fijian Customs Statistics (Fijian $). Statistics before 1979 taken from Wells (1979).

Source	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Am Samoa	0	0	0	0	0	0	0	0	0	0	0	155	1591	0	0	0
Australia	0	31	3	71	420	1051	0	43	482	1978	6258	70148	34829	33858	148104	3637
Bahamas	0	0	0	0	26	0	0	0	0	0	0	0	0	0	0	0
Brazil	0	0	0	0	0	0	0	0	1129	0	0	0	0	0	0	0
China	8	0	70	0	133	180	497	222	0	3790	2620	3236	1579	3363	0	1464
Cook Is	0	0	40	60	0	0	0	0	0	0	0	0	0	0	0	0
F Polynesia	0	0	0	0	0	0	837	1033	0	0	0	0	333	76	0	91
FR Germany	48	0	0	363	0	13	0	0	0	0	0	0	0	0	0	0
France	3	0	0	43	0	0	0	0	0	0	0	0	0	0	0	0
Hong Kong	2287	1748	2105	2608	2562	671	3505	1750	1099	19946	12186	44992	18205	76824	63040	34311
India	2707	2826	1991	1242	4573	3961	6042	8734	8664	6703	9131	5477	630	8731	182625	8461
Indonesia	0	5	0	0	0	822	0	311	0	0	0	0	0	295	0	0
Italy	119	115	336	140	507	24	629	1020	495	806	935	412	613	388	0	0
Japan	145	339	105	0	0	0	0	0	0	10085	13175	2718	13495	18276	48080	1697
Kiribati	0	0	0	105	0	51	0	150	341	214	0	0	0	0	0	0
Malaysia	0	0	0	0	0	0	0	0	0	3753	0	0	0	0	0	0
Mexico	0	0	326	0	0	0	0	0	0	0	0	0	0	0	0	0
N Caledonia	0	0	0	0	0	0	0	0	0	0	0	12162	5169	4288	0	0
N Zealand	316	9	12	0	6	20	0	47	746	162	5453	5914	12129	16760	10603	14557
Nauru	0	0	0	0	0	0	0	0	40	0	0	0	0	0	0	0
Nigeria	0	0	0	0	0	78	0	0	0	0	0	0	0	0	0	0
Other Pac Is	0	0	0	0	0	0	0	477	519	0	0	0	126	0	0	0
Others	0	0	0	0	0	0	0	291	0	0	0	0	0	0	0	0
Pakistan	0	4	0	0	0	0	0	0	0	56	0	0	0	0	0	0
Philippine	130	149	316	66	999	1519	8723	19041	35050	51487	85269	94807	84884	63153	106758	88542
S Africa	0	0	0	0	14	0	0	0	0	50	578	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	311	0	54	0	16	0	0	150	0
Solomons	0	0	0	0	0	0	0	0	0	0	0	0	15	71	15	0
Switzerland	0	0	0	0	0	0	0	0	0	0	0	0	561	0	0	0
Taiwan	342	152	0	8	59	695	3956	3861	3895	9313	18234	20583	53348	40378	24793	91
Thailand	0	0	0	0	0	0	0	1839	65	1259	0	285	0	29	0	0
Tonga	0	37	10	0	0	0	730	81	60	42	12	0	331	778	0	0
Tuvalu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1897	1402
UK	169	0	5	0	0	0	103	420	132	0	73	142	0	0	0	0
USA	0	2	108	0	9	4718	1194	982	25	7775	6232	3513	7545	1797	13187	1726
W Samoa	0	0	39	0	118	222	54	722	355	127	0	597	23	0	0	0
Total	6274	5417	5466	4717	9426	14025	26270	41100	53097	117600	159578	265157	235406	269065	249501	163145

Table 63. Destination of exports and re-exports of "worked tortoiseshell and articles of tortoiseshell, etc", Category 899-100, reported in Fijian Customs Statistics. All values in Fijian $. Statistics before 1979 were taken from Wells (1979).

Destinat'n	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Am Samoa	1472	264	818	407	24	75	1490	7758	6253	9085	3188	488	879	210	4064	468
Australia	193	0	257	717	1182	0	958	0	0	282	1174	30	1737	205	900	0
Canada	3	2	45	0	0	0	0	0	0	0	0	0	0	0	0	0
Cook Is	16	3	0	0	0	0	0	0	0	0	0	0	0	0	2456	704
Denmark	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F Polynesia	0	0	0	220	200	0	383	0	0	0	0	0	0	0	1438	2693
FR Germany	278	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Guam	344	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
Hong Kong	0	0	0	0	0	0	0	0	0	0	1778	0	0	6000	5688	0
India	0	0	0	0	0	0	0	0	0	0	0	0	150	0	0	0
Italy	2508	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Japan	20	0	1095	0	12	0	0	0	0	0	0	2250	6250	20987	5050	157210
Kiribati	0	0	0	0	0	0	0	0	0	1673	0	0	0	0	0	0
Line Is	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Marshall I	464	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N Caledonia	213	0	0	2127	949	1167	40	0	0	7516	1535	5561	1013	1174	0	0
N Zealand	0	17	0	0	0	259	462	0	0	193	350	1254	2259	581	960	0
Norfolk I	0	0	0	0	0	0	0	0	0	0	0	24	0	0	0	0
Solomons	0	0	9	0	0	0	16	0	0	0	0	0	0	0	0	0
Taiwan	0	0	0	0	0	0	0	0	0	448	0	0	0	0	0	0
Tonga	0	0	0	0	0	0	0	0	0	768	363	0	0	0	0	1696
UK	0	0	539	237	0	0	0	0	0	0	0	0	0	0	0	0
USA	401	630	156	1246	1444	1651	385	953	404	14375	5078	2918	261	4090	1142	0
Vanuatu	146	0	0	763	107	0	506	0	0	0	0	604	0	2843	2025	0
W Samoa	370	104	523	79	0	0	0	0	160	787	657	0	0	518	1241	334
Total	6471	1020	3442	5800	3918	3152	4240	8711	6817	35127	13763	13129	12549	36598	24964	163105

Table 64. Imports of raw bekko and other tortoiseshell from Fiji reported in Japanese Customs Statistics. There were no other imports from Fiji between 1950 and 1986.

Year	1956	1962	1963	1964	1965	1966	1967	1968	1969	1972	1973	1974
Bekko (kg)	23	17	198	516	341	118	382	136	306	169	607	131
Other shell	0	0	0	0	0	0	0	0	0	101	0	0

Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Bekko (kg)	91	189	82	399	539	328	162	280	309	242	294	497

POPULATION: Chelonia mydas

Nesting sites Much of the 450-km coastline is lined by mangrove vegetation, beaches suitable for turtle nesting comprising some 20-30 km in all; C. mydas nesting has been recorded at Organabo (3.5 km), Farez (4 km) and Pointe Isère (4 km), with sparse nesting also at Azteque, Awara-Bois Tombé, Kawana and Les Hattes (Fretey, 1984a, 1987 and in litt., 1 September 1982). The C. mydas nesting in French Guiana probably belong to the population nesting in Suriname.

Nesting numbers Fretey (1984a) estimated the numbers of females nesting in the whole of French Guiana in 1977, 1978 and 1979 respectively were 120, 83 and 112. He put the numbers of females using the beaches at Pointe Isère, Farez and Forganabo at around 100; beaches at Les Hattes and Kawana are little-frequented. Available nesting data are summarised in Table 65.

Table 65. C. mydas nesting data for French Guiana beaches (data from Fretey, 1984a).

Beach	Nests per night		Nests per season
	average	maximum	
Farez	12	16	480
Pointe Isère	8	15	300
Kawana	1.5	5	72
Awara	1.5	7	100
Les Hattes	5	18	-

Nesting season C. mydas nesting has been recorded from April to July, with a peak at the end of May (Fretey, 1987).

Foraging sites No direct information; but C. mydas nesting in French Guiana are likely to migrate, as do many of the Suriname nesters, to foraging grounds off the coast of Brasil (Fretey, 1987).

Migration See previous paragraph.

POPULATION: Eretmochelys imbricata

The species appears to be very rare in French Guiana; none was seen on the nesting beaches in 1977-1979 (Fretey and Lescure, 1979), until a single nest was found at Apotili in 1986 and two in 1987 (Fretey, 1987). Pritchard (Pritchard and Trebbau, 1984) found that between one and five E. imbricata nested per season in the late 1960s and early 1970s.

Fretey and Lescure (1979) suggest it is not impossible that E. imbricata previously nested in the country but was extirpated by over-exploitation.

THREATS

Some of the French Guiana beaches are much frequented by tourists, with much disturbance of nesting turtles at night. Many early nests are excavated by

turtles arriving later in the season (this applies mainly to the Dermochelys population, it is unknown to what extent C. mydas is so affected). The dynamic geomorphology of the coastline seems likely to lead to significant changes in nesting numbers. Domestic dogs are also a threat to turtle nests, and a programme aimed at controlling the population of strays was initiated in 1986 (Fretey, 1987).

EXPLOITATION

Commodity Turtle meat and eggs are eaten sporadically by the coastal people of French Guiana (Fretey, 1984a).

Hunting intensity The total level of turtle harvest is thought to be fairly low, probably about one a week (Reichart pers. comm., 1986). Only four coastal families at Yailimpaipo and Awara are said to eat turtle meat regularly. A few turtles are killed accidentally in fishing nets (Fretey, 1984a). There is some demand for turtle meat in expensive restaurants in Cayenne, which is supplied by local hunters (Fretey, 1979). The total number of eggs of all species (mostly D. coriacea) collected by the Indians is estimated to be about 30 000 (Fretey, 1984a). Fretey (1976) reported that Indians from Suriname used to cross over the border in boats to kill turtles and collect eggs.

Hunting methods Apart from accidental capture in fishing nets, most turtles are caught on the nesting beaches.

Historical trends Fretey (1986) reported that turtles were formerly captured on a massive scale to supply meat for ships and for local sale. In the late 18th century some 300 C. mydas were captured each year for sale in Cayenne, although the indigenous inhabitants had taboos against turtle meat. In the 19th century turtles were used as a food supply by some prison establishments, but there has been very little exploitation in recent years.

Domestic trade Turtle meat bought from Indian and Creole hunters features regularly on the menus of exotic restaurants in Cayenne (Fretey, 1979).

International trade As an Overseas Department of France, French Guiana is considered a part of the EEC and is covered by France's acceptance of CITES (18 May 1978). Therefore, shipments between French Guiana and France are not considered international trade, and wildlife exported directly to another European Community country does not require CITES permits. Until recently, France had reservations on C. mydas and E. imbricata and therefore did not adhere to CITES trade restrictions. EEC Regulation 3626/82 required the uniform implementation of CITES with effect from 1 January 1984, and the withdrawal of all reservations. France formally withdrew its reservations on 10 December 1984. CITES Annual Reports contain no reference to any trade with French Guiana in turtle products The Customs reports consulted contain no reference to trade in turtle products with French Guiana.

LEGISLATION

Arrêté Préfectoral No. 172/ID/2B, 31 January 1975.
Prohibits all hunting and trade in D. coriacea. This includes all parts, products and eggs. Turtle eggs may not be collected even for scientific purposes.

Arrêté Préfectoral No. 813 ID/2B, 15 April 1978.

Capture and destruction of all species of sea turtle is prohibited between 1 April and 31 August.

Collection, possession, sale, purchase or offering for sale of all turtle eggs is prohibited.

Arrêté Préfectoral No. 2312 1D/2B. 30 October 1982.

The nesting beach at Les Hattes is completely protected: all species of sea turtle and their eggs are protected.

POPULATION: Chelonia mydas

Nesting sites The most important known site is Scilly (Manuae) atoll, situated at 16°40'S, 154°40'W, in the Leeward Islands sector of the Society Islands group (Anon., 1979; Lebeau, 1985; Hirth, 1971). Mopelia, Tupai and Bellinghausen, also in the Leeward Islands, appear to be of lesser importance, and there is reportedly some sparse nesting in the Marquesas and on most atolls in the north of the Tuamotu group (Lebeau in litt., 1986). Nesting on Scilly is concentrated on the three islets in the south-east of the atoll; Motu Papai (Rahi), Motu Otue Oia and Motu Honu (Anon., 1979).

Nesting numbers Department of Fisheries staff recorded 8-13 sets of tracks per night along about 3.5 km of beach on Motu Papai (= Rahi) and Motu Otue Oia, and 8-10 tracks/night on Motu Honu decreasing to 1-3 tracks/night (Anon., 1979). Surveys were made in 1972, 1973 and 1979, but the length and timing of each visit is not clear, nor is the percentage of tracks that ended in nesting.

Lebeau (1985) reported on three visits to Scilly in 1983-1984. Total number of tracks observed and mean number of emergences per night on the three south-east islets are shown in Table 66. Table 67 shows the estimated total for the three south-east islets, estimated total for all of Scilly, and the mean emergences per night on Scilly.

Lebeau (1985) concluded that around 400 females were nesting annually on Scilly at the time of his visits, with a total of around 800 nests and 80 000 hatchlings a season. There are suspected to be 10-15 nests annually at several sites in the northern Tuamotu group and the Marquesas (Lebeau 1986, in litt.), and the total nesting number in the Tuamotu and Marquesas groups combined is suspected to be approximately equal to the number on Scilly alone.

Trends in nesting numbers Local informants, reported in Anon. (1979), stated that in 1940-1950 it was not unusual to be able to turn 100-150 females a night on the Scilly nesting beaches; if correct, this indicates a very substantial decline in nesting numbers. Such decline appears to have continued into recent years (although it is unknown to what extent this is an artefact of natural seasonal fluctuations); Anon. (1979) recorded 8-13 emergences a night on Motu Papai (= Rahi), while Lebeau in 1983-84 recorded three at most. There are similar figures for the remaining two of the three south-east islets, which between them hold most nesting in Scilly. Decline is attributed by Anon. (1979) to excess harvest of adults for food.

Nesting season According to Anon. (1979) there is some nesting throughout the year, but with a well-defined peak season between September and December. Lebeau (1985), however, found most signs of nesting during his October visit, fewer signs in February, but least in December-January.

Foraging sites Little specific information is available. Lebeau (1986, in litt.) reports that juvenile C. mydas, greater than 1-2 years of age, are frequently seen over the outer reef slope of many atolls in Polynesia.

Migration While some C. mydas appear to be present throughout the year at Scilly, long distance movements to possible foraging grounds, mainly in the Melanesian region of western Oceania, have been demonstrated by tag returns (summarised in Table 68).

Table 66. Total tracks observed and mean emergences per night, on the three south-east islets of Scilly Atoll during three surveys (data from Lebeau, 1985).

	Motu Papai	Motu Otue Oia	Motu Honu	Total
4-18 February 1983				
Tracks	40	13	16	69
Mean/night	2.8	0.9	1.1	4.9
15 October-3 November 1983				
Tracks	49	25	26	100
Mean/night	2.9	1.5	1.5	5.9
20 December-7 January 1983-1984				
Tracks	10	13	15	38
Mean/night	0.59	0.8	0.9	2.2

Table 67. Estimated total number of emergences on Motu Papai, Motu Otue Oia and Motu Honu; estimated total for all of Scilly; estimated mean nightly emergences for all of Scilly (data from Lebeau, 1985).

	February 1983	October 1983	December 1983-January 1984
Estimated total emergences on 3 SE islets	84	100	52
Estimated total for all Scilly	107	133	87
Estimated mean nightly emergence	7.6	7.8	5.8

Table 68. Recovery sites of turtles tagged at Scilly, French Polynesia (data from Anon., 1979; Lebeau 1985).

Date tagged	Date recovered	Place recovered
30 April 1972	9 August 1972	Tonga (Vavau Is)
"	26 July 1972	Fiji (Rabi)
"	14 September 1973	Vanuatu (Maskeline Is)
5 December 1972	15 January 1975	New Caledonia
"	July 1974	Vanuatu (Malekula)
"	15 May 1975	New Caledonia (Baie de Gomen)
"	October 1973	Vanuatu (Anatom)
"	3 October 1974	Fiji (Kandavu Is)
"	15 October 1974	Fiji (Kandavu Is)
"	1 August 1974	Fiji
31 December 1983	March 1984	Cook Islands

POPULATION: Eretmochelys imbricata

Although E. imbricata is known to occur in French Polynesian waters, it is seen less frequently than C. mydas, and has been cited as very uncommon (Anon./SPC, 1980). While the species may be suspected to nest in the area, no information is available on nesting sites or numbers, or on favoured foraging sites.

EXPLOITATION

Commodity Tahitans are said to be very fond of turtle meat and to eat it regularly (Anon., 1979). Eggs are also said to be collected on a subsistence basis (A. Lebeau in litt., 1986).

Hunting intensity The current intensity of exploitation is not known. P. Galenon (in litt., 15 September 1986) claimed that it had now ceased, but A. Lebeau (in litt., 1986) implied that it still continues on a subsistence basis.

Hunting methods The only hunting method that has been documented for French Polynesia is the turning of nesting females on the beaches (Anon., 1979).

Historical trends Harvests on Scilly were said to have declined over the 20-30 years preceding 1979; formerly, 100-150 turtles could be turned on the nesting beach in a single night (Anon., 1979).

Domestic trade There is some local trade in turtle meat. Trade in carapace is said to be very limited as it is now illegal (A. Lebeau in litt., 1986).

International trade CITES Annual Reports contain no records of commercial exports of sea turtle products from French Polynesia. However, three countries have reported importing small numbers of "shells" and "bodies" from French Polynesia, mostly for personal purposes or seized on entry. These are shown in Table 69.

Table 69. All trade in C. mydas, E. imbricata or unspecified sea turtle products involving French Polynesia recorded in CITES Annual Reports since 1976. The numbers refer to shells or bodies reported as imports to the countries given.

Year	E. imbricata	C. mydas	Cheloniidae
1984	2 Switzerland		1 Canada
1983	1 USA	2 USA	
1982	2 USA		
1981		3 USA	
1980		1 USA	1 USA
1978	2 Switzerland		

No evidence was found in Customs reports of any exports of tortoiseshell products from French Polynesia. However the Philippines Customs reports

show exports of 425 kg, 352 kg and 150 kg of raw tortoiseshell to "French Pacific Islands" in 1976, 1977 and 1978 respectively (Wells, 1979).

LEGISLATION

French Polynesia is an Overseas Territory of France, however it is not included in the French acceptance of CITES. It does not form part of the European Economic Community.

Déliberation No 71-209 du 23 décembre 1971 réglementant la pêche de la tortue de mer (C. mydas) dans le territoire de la Polynésie française.

Prohibits the capture of sea turtles (C. mydas) with shells of less than 65 cm in length.
Prohibits the capture on land of turtles from 1 November to 31 January.
Prohibits the capture at sea of turtles from 1 June to 31 January.
Prohibits the sale of sea turtles for commercial purposes.
Prohibits the collection of turtle eggs on land.
The capture of sea turtles of all sizes may be permitted for purposes of scientific research.
Some turtles may be taken in accordance with quotas set by the Government.
Turtles must not be held longer than 10 days in containers which are not sheltered from the sun.
During transportation turtles must be handled in a way which causes no unnecessary suffering and must in particular be shielded from the sun.
The slaughter of turtles must be performed under the strictest hygienic conditions.

Proposed Legislation. (Supplied by the Ministère du Tourisme et de la mer).

Extension of legislation to include E. imbricata and D. coriacea.
Prohibition of the capture of sea turtles at all times except for scientific research and subsistence use on certain islands.
Prohibition of the collection of turtle eggs at all times except for scientific research and breeding purposes.
The possession and transportation of sea turtles to become illegal except for scientific research, breeding purposes and subsistence use.
The sale of all sea turtles to become illegal except for breeding purposes.
The import of all sea turtles and the export of breeding turtles to be prohibited.

RANCHING

A small-scale Green Turtle rearing trial was undertaken by the Fisheries Department at Rangiroa from 1971 to 1972. About 50 hatchlings were reared experimentally for a year. They were fed mainly on fish scraps, but as no suitable plant material could be found, they developed deficiency symptoms and had to be released. Over the year they grew rapidly, and attained an average weight of 5.6 kg (Anon., 1979).

A family on Scilly Atoll was said to have been experimenting with rearing hatchling C. mydas in floating cages before releasing them after 9-12 months. This trial was still in progress in October 1979 (Anon., 1979).

No recent information is available. Loveridge and Williams (1957) cite a record of E. imbricata from the Gabon coast (whether nesting or not is unclear), and of C. mydas nesting on the Loango Coast (this region of the former French Equatorial Africa appears to lie within present day Gabon).

FAO Fisheries statistics recorded the catch of 2 t. of marine turtles (unspecified) in Gabon in 1982. This level of harvest was inferred to have continued in 1983 and 1984.

International trade Gabon is not a Party to CITES. The only record of trade in turtle products recorded in CITES Annual Reports was the import of one shell of C. mydas to Italy in 1984.

LEGISLATION

Waters and Forests Act, 22 July 1982.

Products of fisheries may not be sold without valid certificates of origin. The export of all wildlife products requires a certificate of origin and an export permit.

GAMBIA

No information is available on sea turtle occurrence.

International trade Gambia acceded to CITES on 26 August 1977. The only record of trade in turtle products recorded in CITES Annual Reports was the illegal import of one shell of E. imbricata and one of C. mydas to Denmark in 1984.

LEGISLATION

Wildlife Conservation Act 1977. 14 February 1977.

Includes all parts, eggs, nest etc.

Any animal found in the Gambia is protected. The minister may declare open seasons, but a licence is required for hunting.

All immature animals or females accompanied by young are completly protected.

Commercial sale is prohibited.

No export or import of any wild animal (inluding parts etc) is permitted except under special circumstances with a licence.

Little recent information is available; Brongersma (1982) reported that both C. mydas and E. imbricata have been recorded to nest, but gave no details of sites or numbers. According to Parsons (1962), the coast of Ghana is one of two areas on the western seaboard of Africa that are most frequented by turtles (the second being the Banc d'Arguin in Mauritania). Cansdale (1955) stated that C. mydas is the most common turtle species along the coast of Ghana (and probably in West Africa generally). A survey of the whole coastline carried out on foot from July to October in 1974 found evidence of nesting at only one site, near the town of Anyaman, where three nests were observed. It is not known what species was involved, but a dead C. mydas was found on the beach nearby. Local inhabitants indicated that most nesting occurred in the Accra-Anyamam area. They reported that nesting occurred from July to December, with a peak in November-December (Toth and Toth, 1974).

EXPLOITATION

Commodity Both turtle meat and eggs of C. mydas are eaten by the inhabitants of Ghana; Irvine (1947, cited in Loveridge and Williams, 1958) described how both commodities were customarily cooked in the Gold Coast. Toth and Toth (1974) reported finding the shells of 33 C. mydas, six C. caretta and two D. coriacea during their survey of the coastline. They said that both eggs and adults are regularly taken and that what is not eaten locally is taken to the markets, chiefly Prampram and Accra, for sale. They felt that there would be strong opposition to any attempts by the Department of Game and Wildlife to enforce the protective legislation, and said that local traditions of protecting some female turtles and their nests had existed but were now dying out.

International trade Ghana acceded to CITES on 14 November 1977. There is no record of trade in turtle products with Ghana recorded in CITES Annual Reports.

LEGISLATION

The Wild Animals Preservation Act, 22 March 1961.

The following species have total protection;

E. imbricata
D. coriacea

The Act empowers the President to amend the lists and empowers the Minister to authorise the taking of protected species for scientific purposes. It also provides for the requirement of an export permit for the export of trophies. The import of trophies, exported from territories to which the Convention of the Protection of Fauna and Flora of 1933 applies, is prohibited except on production of a certificate of lawful export. (Trophies are defined as any animal mentioned in the Schedules to the Act, dead or alive, or any readily recognisable part or product thereof.)

POPULATION: Chelonia mydas

Nesting sites Bacon (1981) and Carr et al., (1982) reported no nesting in the Grenadines and nesting on Grenada only at Marquis Island. However, Finley (1984) reported nesting at Palmiste Bay; St Mark's Bay, Bacolet Bay, St David's Bay, Duquesne Bay, La Seuis Bay, David Bay, Rathan Bay, Levera Beach, Great River Conference Beach, Sandy Island, Antoine Bay, Grenada Bay, Grand Mal Bay, Morne Rouge/Quantine, Point Saline to Petit Cabrites Point, Black Bay, Three Sisters Islands, North Bay and Halfmoon Bay on Isle de Ronde, and North Bay on the Isle de Caille.

Nesting numbers Finley (1984) estimated the population of nesting females in 1982 to be 200 ± 50. Bacon (1981) and Carr et al. (1982) stated that nesting was rare on Grenada. Carr et al. (1982) reported two records of Green Turtles emerging on Marquis Island but stated that the species did not nest in the Grenadines.

Nesting season Nesting recorded by Finley (1984) occurred between the months of April and September.

Foraging sites Green Turtles were reported by Carr et al. (1982) to be the most numerous species around Grenada. Bacon (1981) reported frequent foraging by both adults and juveniles at Woburn, La Sagesse, Crouchu, Soubisse, La Poterie, Black Bay, and around all islands in the Grenadines. Finley (1984) noted foraging between Point Saline and Quarantine Point, and at Glover Island, Grand Mal Bay, Hog Island, Latante Bay, Galby Bay, Great Bacolet Bay, David Bay, Levera, Three Sisters Islands, Isle de Ronde and Isle de Caille.

Migration Carr et al., (1982) reported the capture at Carriacou Island and Black Bay of two Green Turtles originally tagged on Aves Island. A head-started Green Turtle that was released in Suriname was also reported by Carr et al., (1982) to have been caught around Carriacou Island.

POPULATION: Eretmochelys imbricata

Nesting sites Bacon (1981) reported nesting on and around Grenada at Little Bacolet Bay, La Sagesse Bay, Soubisse, Pearls, Levera, Hog Island, Green Island, Sandy Island and Caille Island. In the Grenadines, nesting was recorded by Carr et al. (1982) at several beaches on Carriacou Island (Petit Carenage, north of Tarlton Point, Grand Bay, Anse La Roche, Bogles and Hillsborough Beach) and on nearby Sandy Island, White Island, Mopion, Punaise, Petit Saint Vincent and Petit Martinique. Other nesting sites were reported by Finley (1984) at St Davids Bays, Duquesne Bay, La Seuis Bay, David Bay, Irving Bay, Rathan Bay, Great River Conference Beach, Grenada Bay, Antoine Bay, North Bay and Halfmoon Bay on Isle de Ronde, Three Sisters Islands, St Mark's Bay Black Bay, Grand Mal Bay and Morne Rouge/Quantine.

Nesting numbers Bacon (1981) reported occasional nesting on Grenada and, according to Carr et al. (1982), Hawksbills emerged in small numbers during the summer months, all along the southern and western coasts. Finley (1984) estimated the population of nesting females in 1982 to be greater than 500, but this was not based on field surveys. Hawksbills were the prevalent nesters in the Grenadines (Carr et al., 1982).

Nesting season Carr et al. (1982) noted Hawksbills emerging during the

summer months on Grenada and from April to October on Carriacou. Finley (1984) recorded nesting between April and September.

Foraging sites Bacon (1981) reported frequent foraging by adults and juveniles and gives Woburn, La Sagesse, Crouchu, Soubisse and La Poterie as foraging sites around Grenada. Finley (1984) recorded foraging at Glover Island, Levera Bay, Grand Mal Bay, Hog Island, Latante Bay, Galby Bay, Great Bacolet Bay, Three Sisters Islands, Isle de Ronde, Isle de Caille, David Bay and from Point Saline to Quarantine Point.

EXPLOITATION

Commodity The meat of all species was eaten locally, but Hawksbill and Green Turtle meat was preferred (Finley, 1984). Carr et al. (1982) reported a lively trade in stuffed turtles and shells, and Finley (1984) commented that Hawksbill and Green Turtles were prized for their "backs" (probably carapace), with a marked preference for those of the Hawksbill.

Hunting intensity From a survey conducted in 1981 it was estimated that about 1000 turtles were caught annually, 70% of which were juveniles (Finley, 1984). For the period 1980-1982 Finley (1984) estimated an annual catch of 100-150 (2500 kg) C. mydas and 100-200 (5000 kg) E. imbricata. It was also estimated by Finley (1984) that 6000-10 000 eggs were collected and, 100 nesting females, and 50-75 sea turtles at sea were taken annually for subsistence use. FAO Fishery Statistics show catches of C. mydas (in metric tonnes) for the years 1981 to 1984 to be 10, 18, less than 0.5 and 2 respectively. Carr et al. (1982) considered exploitation of sea turtles in Grenada to be moderately intense and stated that most turtle fishing occurred along the southern and eastern shores at Woburn, La Sagesse, Crouchu, Soubisse and La Poterie. Finley (1984) reported landing sites for Green Turtles and Hawksbills at Sauteurs, Grenville, Calliste, Bacolet and Calivigny.

Hunting methods Turtles were taken on nesting beaches (Carr et al., 1982), and in some places were caught in trammel nets which were set on the reefs, especially at times of nesting (Finley, 1984). Turtles were also caught by divers who will shoot them while spearfishing (Finley, 1984).

Historical trends FAO Fishery Statistics show minimal catches of 50 t for the years 1965-1973 and less than 0.5 t for 1974-1980.

Domestic trade The meat of all species was eaten locally and sold for EC$1.75 a lb (EC$3.85 a kg) (Carr et al., 1982). Finley (1984) reported the sale of turtles at EC$0.90 a lb (EC$1.98 a kg) live weight at local markets. There was a lively trade in stuffed turtles and shells in the Grenadines between local fishermen and tourists passing through in yachts (Carr et al., 1982). On Grenada, turtle products sold for high prices in the tourist shops, one adult Hawksbill being priced at EC$750.

International trade Japanese Customs statistics show imports from Grenada in 1973, 1975 and 1977 of 499 a kg, 132 a kg and 59 a kg respectively of unworked tortoiseshell. CITES annual reports for the period 1977-1984 record import to the USA from Grenada of two shells and one stuffed body of E. imbricata, two shells and one stuffed body of C. mydas, and one Cheloniidae shell. Grenada is not party to CITES.

RANCHING/HATCHERIES

A head-start project for Hawksbill on Carriacou was being carried out in 1981. This involved the purchase of eggs from fishermen and incubation under protected conditions. Up until March 1981, 2706 eggs had been collected and 1042 hatchlings had been released (Goodwin, 1981).

LEGISLATION

The Birds and Fish Protection Ordinance 1931

Establishes a close season for turtles from 1 May to 30 September inclusive. It is prohibited to kill, wound, take, or have in possession, any turtle, during this time. It is prohibited to take, destroy or have in possession, any turtle or its eggs, on land at any time. It is prohibited to take, sell or purchase turtles of less than 25 lb (11.4 kg).

POPULATION: Chelonia mydas

Nesting sites Nesting is reported at the following sites: Ilet à Fajout; Ilet à Caret; Plage Ramée (Basse Terre); Ilet à Kahouanne; Plage de Grande Anse near Deshaie (Basse Terre); Plage de Grande Anse near Trois Rivières (Basse Terre); St Clair (Basse Terre); Plage Viard (Basse Terre); Anse Bertrans (Grande Terre); Port Louis (Grand Terre); St François (Grand Terre); Iles de la Petit Terre; Les Saintes; Ballet beach (Marie Galante); La Deserade; Long Bay (St Martin); Flat Island (St Martin); Anse de Grande Saline (St Barthélemy) (Carr et al., 1982; Meylan, 1983).

Nesting numbers Bacon (1981) considered Green Turtle nesting to be frequent on Guadeloupe and its dependencies. Carr et al. (1982), however, noted informants' reports that only a few turtles nested on any given night on any beach in Guadeloupe. Meylan (1983) noted that the frequency of nesting by all marine turtle species on St Martin was apparently quite low and that very little evidence of nesting was found during a survey on St Barthélemy, with the only nesting attributed by informants to the Green Turtle being that of a single turtle that emerged at Anse de Grande Saline in 1978.

Trends in nesting numbers There appears to have been a very definite decline in turtle population levels on Guadeloupe; residents of St Barthélemy noted a decline in local turtle populations and sea turtle stocks at St Martin were considered to be depleted (Meylan, 1983). Turtle nesting on Guadeloupe has reportedly declined at beaches near Deshaies, Capesterre and St François, and to have ceased altogether on most of the west coast of Basse Terre (Meylan, 1983).

Nesting season April to September on Guadeloupe (Meylan, 1983).

Foraging sites Meylan (1983) reported Green Turtle foraging in the Grand Cul-de-Sac Marin near Peiti-Bourg and at Les Saintes and Marie Galante off Guadeloupe, and at Point du Bluff on St Martin. ECNAMP (1980, cited in Meylan, 1983) identified presumed Green Turtle foraging sites around St Barthélemy at Anse du Gouverneur and Anse de Grande Saline on the southern coast, off the north-western peninsula near Columbier, and to the south-west of Ile Fourche.

POPULATION: Eretmochelys imbricata

Nesting sites Nesting is reported at the following sites: Ilet à Fajout; Ilet à Caret; Plage Ramée (Basse Terre); Ilet à Kahouanne; Plage de Grande Anse near Deshaie (Basse Terre); Plage de Grande Anse near Trois Rivières (Basse Terre); St Clair (Basse Terre); Plage Viard (Basse Terre); Anse Bertrans (Grande Terre); Port Louis (Grand Terre); St François (Grand Terre); Iles de la Petit Terre; Les Saintes; Ballet beach (Marie Galante); La Deserade; Long Bay (St Martin); Flat Island (St Martin) (Carr et al., 1982; Meylan, 1983).

Nesting numbers Bacon (1981) considered nesting to be frequent on Guadeloupe and its dependencies, although Meylan (1983) stated that Hawksbills did not appear to nest in any abundance on Guadeloupe. Reports of incidental nesting at Flamand on St Barthélemy probably referred to Hawksbills (Meylan, 1983).

Trends in nesting numbers See C. mydas above.

Nesting season April to September on Guadeloupe (Meylan, 1983).

Foraging sites Hawksbills are year-round residents and are reported to forage off the central-east coast of Basse Terre near Petit-Bourg; foraging areas (for turtles generally) have also been reported around Marie Galante and Les Saintes (Meylan, 1983).

EXPLOITATION

Commodity The meat and eggs of all species of turtle are consumed; there is also a great deal of trade in turtle souvenirs of all kinds, including stuffed turtles, polished carapaces, tortoiseshell jewellery and artifacts (Carr et al., 1982; Meylan, 1983).

Hunting intensity Meylan (1983) stated that marine turtle were exploited to a greater extent on Guadeloupe than anywhere else in the Lesser Antilles with the possible exception of Martinique. Most exploitation was directly tied to the tourist industry. Carr et al. (1982) indicate that fisheries statistics for Guadeloupe show an estimated annual take of 30 tonnes of sea turtle (whole animal weight, all species combined) for the period 1959-76; this includes figures for St Barthélemy and St Martin although these are said to be only a small portion of the total. Fretey (1984b) stated that the real take was almost certainly considerably higher than this as there was little systematic control of the fishery.

Hunting methods Turtles are taken in nets (Meylan, 1983) and presumably by other methods.

Domestic trade As noted above, there is very heavy trade in tortoise souvenirs to tourists. Although some of this evidently results in export of the products, some will be to mainland France and thus strictly domestic trade; it is not possible to quantify this. Meylan (1983) noted that the largest producer of souvenirs was the prison at Basse Terre where prisoners were trained to manufacture them; the prison sold products both wholesale and at retail level. In December 1978 there were the products of at least 103 turtles (including 37 Green Turtles and 28 Hawksbills) in the storerooms there; this was considered a low number at that time (Meylan, 1983). In 1978 polished carapaces were priced at US$69-184 (Meylan, 1983).

International trade Meylan (1983) notes that some of the tortoiseshell worked in Guadeloupe is obtained from other islands in the Lesser Antilles. She reported that tortoiseshell is exported to France, although as noted above this is strictly domestic trade.

Japanese Customs statistics record the import of raw bekko (shell of *E. imbricata*) from the French West Indies (Table 70), although they do not specify whether these refer to Guadeloupe or Martinique. Fretey (1984b) cited these figures as indicating exports from Guadeloupe. In 1977, Japanese Customs statistics also recorded the import of 38 kg of "other tortoiseshell" from the French West Indies. Official statistics from the Dominican Republic show the export to Guadeloupe of 1519 kg of turtles between 1979 and 1983 (Ottenwalder, 1987b).

Guadeloupe is covered by the French CITES report, and no trade in turtle products with Guadeloupe has been recorded by other Parties.

Table 70. Imports of raw bekko from the French West Indies (kg) recorded in Japanese Customs statistics. No other imports were recorded between 1950 and 1986.

Year	1964	1969	1970	1975	1976	1977	1978	1979	1980	1981	1982
	183	145	266	122	152	198	276	123	196	231	215

LEGISLATION

Arrêté portant réglementation de l'exercice de la pêche marine côtière dans les eaux du département de la Guadeloupe. 26 March 1979.

The collection, sale, transport, import or export of eggs of all species of sea turtle is prohibited.

There is also a minimum size of 60 cm and a close season for C. mydas and E. imbricata from 15 May to 15 September during which capture and sale are forbidden.

The taking, sale, transport, import or export of D. coriacea is prohibited.

The previous Arrêté was modified on 17 August 1983 to extend the close season from 15 April until 15 October.

As an Overseas Department of France, a Party since 18 May 1978, Guadeloupe adheres to CITES. Shipments between Guadeloupe and France do not require CITES permits. Guadeloupe is also included in the EEC, and so EEC Regulation 3226/82 applies. Wildlife exported directly to another European Community country does not require CITES permits.

France had reservations under CITES on C. mydas and E. imbricata until EEC regulations required the uniform implementation of CITES with effect from 1 January 1984, and the withdrawal of all reservations. France formally withdrew its reservations on 10 December 1984.

POPULATION: Chelonia mydas

Nesting sites Although C. mydas occurs in moderate abundance in Guam waters, and can be seen throughout the year, nesting is very sparse; it has been recorded on beaches at the north end of the island (including Tarague Beach and the Naval Facility area), and at a few isolated sites in the east and south (H. Kami in litt., 10 September 1986; Molina, 1979; Pritchard, 1982b). Turtles formerly nested on Cocos Island, off the south coast (H. Kami, cited in Pritchard, 1982b).

Nesting numbers Nesting is very sparse. Ten or fewer turtle nests have been recorded in each year from 1980 to 1986, and although most nests could not be attributed to species, those that could be identified were by C. mydas (H. Kami in litt., 30 October 1986). Only three confirmed C. mydas nests were recorded in 1986, all at the Naval Facility (H. Kami in litt., 10 September 1986).

Trends in nesting numbers Little precise information is available; nesting now no longer occurs on Cocos Island (due to disturbance), and egg harvesting appears to have been more common before World War II (sources cited in Pritchard, 1982b). This suggests some degree of decline in nesting numbers.

Nesting season The three nests recorded in 1986 were laid in May-June. Numbers of turtles in Guam waters are reportedly greater every third year, and numbers within a year are highest in winter (December-February) and late spring (May-June) (Molina, 1979); it is not clear whether these fluctuations bear any relation to nesting acitivity.

Foraging sites No detailed information available; the species occurs throughout the year in Guam waters.

POPULATION: Eretmochelys imbricata

Although the species occurs in Guam territory, and nesting is reported to occur, numbers (including nesting) are lower than C. mydas (H. Kami in litt., 10 September 1986). On available evidence, nesting by E. imbricata would appear to be of very little significance.

THREATS

Little information is available. General disturbance and human activity on nesting beaches appear to be the main threats to nesting turtles (Kami, in Pritchard, 1982b; Molina 1979).

EXPLOITATION

Commodity Johannes (1986) reported that turtle meat rarely featured in the diet of the islanders, although Pritchard (1982b) related that the eggs were "actively sought". In former times, the blood was thought to be a cure for asthma and tuberculosis (Johannes, 1986).

Hunting intensity Turtles are no longer thought to be exploited on Guam (H. Kami in litt., 10 September 1986).

Hunting methods Pritchard (1982) reported that nets were never used for turtle catching but that a few old fishermen were expert at spearing turtles. Some were also caught by skin divers.

Historical trends Levels of exploitation have probably never been high. In 1968 there were two skin divers who specialised in catching turtles and were said to catch 3-4 turtles on a good day (Hendrickson, cited in Pritchard, 1982b). Human interference with turtle nests was said to be a "serious problem" at Tarague beach, but it was thought that it could be controlled in the future (Pritchard, 1982b). Turtle protection legislation was introduced in 1979.

Domestic trade Turtle meat could occasionally be purchased at Perez Market, and sold at US$0.75 a lb in 1968 (Pritchard, 1982b). Newspaper articles indicate that Hawksbill shell jewellery was on sale in several shops in Guam in 1981, and that there had been little enforcement of the protective legislation to that date (Beaver, 1981).

International trade Guam is covered by the USA ratification of CITES (14 January 1974). The only record in CITES Annual Reports of trade in turtle products with Guam was the illegal import to the USA of 27 eggs of C. mydas in 1984.

Customs reports indicate very little trade in turtle products with Guam. Japanese Customs reported importing 21 kg and 43 kg of bekko from Guam in 1952 and 1953, and none since then, although small quantities of worked tortoiseshell items were exported to Guam in 1971 and 1974-1977. Fijian Customs statistics show the export of F$344- and F$4-worth of worked tortoiseshell to Guam in 1970 and 1973 respectively, and the Philippines reported exporting worked shell to Guam in 1979 and 1980.

LEGISLATION

US Endangered Species Act (1973) (q.v.).
All turtles and their eggs are totally protected.

GUATEMALA: CARIBBEAN

POPULATION: Chelonia mydas

Nesting sites There is good turtle nesting habitat, in which C. mydas is known to nest, from Cabo de Tres Puntas south-east to Río Montagua, a distance of c. 45 km (Carr et al. 1982; Rosales-Loessener, 1984). However, Rosales-Loessener (1987) found only three species of sea turtle nesting on the Caribbean coast in 1987, C. mydas not being amongst them.

Nesting numbers C. mydas is said to be the least frequent of the four species nesting along the coast (the others being Eretmochelys imbricata, Caretta caretta and Dermochelys coriacea) (Carr et al., 1982).

Foraging sites Carr et al. (1982) state that some mature Green Turtles forage in Guatemalan waters on a seasonal basis from December to May. Rosales-Loessener (1987) said that an area of Thalassia (16 sq. km) in Bahia la Graciosa was an important feeding site for C. mydas.

Migration At least three C. mydas tagged at the nesting beach of Tortuguero in Costa Rica have been recovered in Guatemalan waters (Carr et al., 1982).

POPULATION: Eretmochelys imbricata

Nesting sites There is reported to be good nesting habitat between Cabo de Tres Puntas and Río Montagua (Carr et al., 1982).

Nesting numbers The Hawksbill is reported to be the most abundant nesting sea turtle (Carr et al., 1982). Rosales-Loessner (1987) counted a total of 53 nests on a 10-km stretch of coast between April and August 1987, and estimated that there were 380-760 nests a year on the whole Caribbean coast.

Nesting season E. imbricata is said to nest May-November, with a peak from June to August (Rosales-Loessener, 1987).

Foraging sites Carr et al. (1982) note that good turtle habitat was apparently almost non-existent, and immature sea turtles were rarely seen anywhere.

THREATS

Incidental catch by shrimp trawlers appears to be heavy; Carr et al. (1982) state that Caretta caretta is the species principally affected.

EXPLOITATION

Commodity Carr et al. report that a subsistence fishery for turtles exists along the Caribbean coast, although do not state the species involved; they also note that eggs are collected and sold in Puerto Barrios and Guatemala City. There is said to be no local use of shell (Rosales-Loessener, 1987).

Hunting intensity Rosales-Loessener (1987) considered that virtually 100% of eggs laid were collected.

Historical trends Before 1981, there was a low-level subsistence catch of turtles (Rosales-Loessener, 1987).

Domestic trade The only domestic trade is the sale of eggs, which are sold by the beach collectors for about Q3 (US$1.11) a dozen and which fetch Q4-5 in Puerto Barrios, the main market.

International trade Guatemala ratified CITES in 1979. Very little trade is recorded. All trade reported by CITES has been with the USA except for a record of "1000 bottles of Chelonia mydas derivatives" (presumably oil) imported to Guatemala from the Cayman Islands in 1980. Trade with the USA (all in the years 1980-84 inclusive) has amounted to: 40 eggs of C. mydas, one body and one shell of C. mydas, 12 eggs of "cheloniidae" and one body, one carving and 28 unspecified products of Eretmochelys imbricata.

GUATEMALA: PACIFIC

POPULATION: Chelonia mydas

Nesting sites Little specific information although the species is reported to nest along the barrier beaches (La Rosario, Las Lisas and El Hawaii) fronting the Chiquimulilla Canal along the eastern half of the coastline (Cornelius, 1981); there is indirect evidence that the species nests, or at least used to nest, in the region of Ocós on the Mexican border (Coe and Flannery, 1967, cited in Cornelius, 1981).

Nesting numbers The population along the Chiquimulilla Canal was considered sizeable by Cornelius (1981); at least 20 individuals a night have been observed along a 15-km stretch of beach during the nesting season in September-October (Cornelius, 1981).

Nesting season Given as September-October (Cornelius, 1981).

POPULATION: Eretmochelys imbricata

No definite evidence has been located that the Hawksbill occurs in Pacific Guatemalan waters. The species does however occur, albeit now apparently in very low numbers, in adjacent Mexican waters and is reported to nest on beaches in El Salvador (Cornelius, 1981); it is thus likely to occur in Pacific Guatemalan waters, even if not to nest there.

THREATS

Incidental catch by shrimp trawlers appears to be heavy. Cornelius (1981) cited reports that 150-200 turtle carcasses washed ashore annually on the south-eastern Pacific coast of Guatemala, a major shrimping ground; it was not stated which species were involved, although it seems likely that a considerable proportion were C. mydas as this is apparently the principal nesting species here.

EXPLOITATION

Commodity Cornelius (1981) stated that only eggs were taken commercially; there was no demand, at least at that time, for turtle skins or meat. However, consideration was being given at that time to the development of a market for the incidental catch taken by shrimp trawlers; it is not clear if this has proceeded any further.

Hunting intensity Egg harvest was described by Cornelius (1981) as likely to be effectively at the level of "total exploitation", with intensive collection in areas where turtles were known to nest.

Historical trends Cornelius (1981) notes that the level of egg harvest increased considerably in the 1960s as improved transport routes allowed egg collecters on the south-eastern coast access to lucrative markets in the highland interior. In 1976 a serious attempt was apparently made to limit the harvest of eggs; it is thought likely that these had not been successful in the long term and that exploitation had reached the previously high levels (Cornelius, 1981).

Domestic trade In 1981 eggs could be purchased at the nesting beaches for 50 cents (presumably US$) a dozen by coastal families or two for 25 cents by tourists. In the large cities the price rose to $1.50 a dozen in the open markets and two for 50 cents in bars and restaurants (Cornelius, 1981).

International trade See GUATEMALA: CARIBBEAN above.

LEGISLATION

Acuerdo Gubernativo - Prohibe captura, circulation y comercializacion de la tortuga verde, 26 October 1971.

The taking, transport and trade in the Green Turtle, <u>C. mydas</u>, and its eggs is prohibited. This decree was initially applicable for a period of five years, its applicability was extended in 1976 to another period of five years.

Acuerdo Gubernativo, 17 February 1981.

Prohibits indefinitely the capture of, or commerce in, all sea turtles.

Although it is suspected that significant nesting by both C. mydas and E. imbricata may occur, and both species are exploited for subsistence purposes, no detailed information is available on nest sites, numbers or foraging grounds (J.B. Zoumanigui in litt., 4 October 1986).

International trade Guinea acceded to CITES on 21 September 1981. There is no record of trade in turtle products with Guinea recorded in CITES Annual Reports.

LEGISLATION

There are no laws protecting sea turtles in Guinea (Ministry of Rural Development).

GUINEA BISSAU

No information available; some nesting might be expected to occur in the Bijagos Archipelago.

International trade Guinea Bissau is not a Party to CITES. There is no record of any trade in sea turtles with Guinea Bissau recorded in the CITES Annual Reports.

LEGISLATION

The Hunting Regulations (12 May 1980), which specify protected species, contain no reference to sea turtles.

POPULATION: Chelonia mydas

Nesting sites The coastline, of around 380 km, consists primarily of mangrove forest and beach areas, the latter extending for some 160 km. Most beaches known to be used by nesting turtles are situated on the far north-west sector of the coast, the largest being Shell Beach (6 km). Nesting by C. mydas has been recorded on Shell Beach, and on smaller beaches around Waini Point (Reichart et al., 1984). Other beaches exist in the west, but no data are available on present turtle nesting. Pritchard and Trebbau (1984) cite the Essequibo Delta area and at least six beaches in the east as C. mydas nest sites; however, nesting tracks were seen only in the far west during an aerial survey in September 1982 and no evidence of nesting on the eastern half of the Guyana coast has been seen in recent years (Reichart et al., 1984).

Nesting numbers Recent information is sparse. Fair numbers appear to have nested in 1964-65, although only one or two nested on Shell Beach during four days in August 1964 (Pritchard, 1969b). Only a few were seen in August 1965, but up to about a dozen were emerging nightly on Shell Beach in April 1967. Reichart et al. (1984, Table 4) records 5-6 nests nightly on Shell Beach in April 1967. An aerial survey (by P. Pritchard) of the north-west coast in June 1983 revealed a single possible C. mydas track. On available evidence the C. mydas nesting population is small. Pritchard and Trebbau (1984) characterise Shell Beach as a nest site of moderate importance, but collectively the Guyana sites are of far less significance than the nearby Suriname beaches.

Trends in nesting numbers No good comparative data are available. Some reputed former nest beaches (species undetermined) in east Guyana appear no longer to be used (Reichart et al., 1984), and some degree of decline seems likely given the exploitation pressure prevailing.

Nesting season Nesting has been recorded between March and August (Reichart et al., 1984).

POPULATION: Eretmochelys imbricata

Nesting sites Nesting by E. imbricata has been recorded on Shell Beach and on smaller beaches around Waini Point (Reichart et al., 1984), however, Pritchard (1987b) considered that the species may have virtually disappeared from the Guianas, which are characterised by muddy shores and contain little typical nesting habitat.

Nesting numbers Recent information is sparse. Fair numbers appear to have nested in 1964-65 (Pritchard, 1969b). Reichart et al. (1984) record 12 nests on Shell Beach in a three-week period in August 1967. Although Pritchard and Trebbau (1984) consider that Shell Beach may be the most important nest site for E. imbricata in mainland South America, absolute numbers appear to be very small.

Trends in nesting numbers No good comparative data are available. Some reputed former nest beaches (species undetermined) in east Guyana appear no longer to be used (Reichart et al., 1984).

Nesting season Nesting has been recorded between June and August (Reichart et al., 1984).

THREATS

Reichart et al. (1984) consider the intensive harvest of eggs and adults to be detrimental to nesting populations. Schulz (1982) reported that the slaughter of females in 1976 continued at the near-100% level reported by Pritchard in 1964-1965. Dalfelt (1978) reported on plans for large-scale sand-mining operations on Shell Beach, for the cement industry; the present situation in this regard is unknown.

EXPLOITATION

Commodity Turtles are heavily exploited for meat and eggs. E. imbricata is also eaten with apparently little ill-effect (Pritchard and Trebbau, 1984).

Hunting intensity It is thought that virtually every turtle nesting in Guyana is killed and probably all the eggs are harvested (Reichart et al., 1984; Pritchard, pers. comm., 1986). Twenty-six turtle carcases, thought to be E. imbricata, were seen on a beach during an aerial survey in 1982 (Reichart et al., 1984).

Hunting methods Female turtles are caught on the nesting beaches, and immature turtles are caught accidentally off shore in trawl nets. A Libyan fishing company which operated shrimp trawlers off Guyana was known to be landing immature turtles which were brought ashore for stuffing (P.C.H. Pritchard pers. comm., 1986).

International trade Guyana acceded to CITES on 27 May 1977. The only trade in turtle products with Guyana recorded in CITES Annual Reports was the import to the USA of six shells of C. mydas and two of Cheloniidae. Japanese Customs reports recorded the import of 27 kg of bekko from Guyana in 1966, and no other turtle products from 1950 to 1986.

LEGISLATION

There are no regulations affecting sea turtles beyond the control of imports and exports as required under CITES (Fuller and Swift, 1985).

POPULATION: <u>Chelonia mydas</u>

Nesting sites Nesting sites were identified at Anse-à-Pitre to Belle Anse, Cayes Jacmel and Raymond, Mayette to Côtes de Fer, Côtes de Fer to Monillage, Baie de Caracol, Petite Anse, Anse-à-chou-chou, and Fond Larange (Kavanaght, 1984). Ottenwalder (1987a) identified nesting sites at Pointe Diamant (Ile-à-vache), east of Jeremie, west of St Marc, and between Laborieux and Pointe des Trois Lataniers.

Nesting numbers Ottenwalder (1987a) concluded that nesting is low and scattered, with no evidence of any large concentrations.

Trends in nesting numbers According to Carr <u>et al</u> (1982), marine turtles once abounded in Haitian waters but this was no longer the case. Green Turtles were, and still are, the most common species around Haiti, but Ottenwalder (1987a) considered them to be seriously depleted and probably still declining.

Nesting season Nesting reported by Kavanaght (1984) occurred in May, July and August, possibly extending to October (Ottenwalder, 1987a).

Foraging sites Foraging was reported to occur at Cayes Jacmel and Raymond and at Côtes de Fer to Monillage (Kavanaght, 1984).

POPULATION: <u>Eretemochelys imbricata</u>

Nesting sites Nesting was reported to occur at Anse-à-Pitre to Belle Anse, Mayette to Côte de Fer, Les Cayes to St Jean, Pointe-à-Gravois to Port Salut, and Anse-à-chou-chou (Kavanaght, 1984). Ottenwalder (1987a) identified nest sites at Pointe de l'Est, near Anse d'Azur and between Laborieux and Pointe des Trois Lataniers.

Nesting numbers Bullis (1984) inferred, from unquantifiable information, possibly low to moderate levels of nesting activity. Ottenwalder (1987a) described nesting levels as unknown but presumably low. Hawksbills are the second most common species around Haiti.

Trends in nesting numbers Carr <u>et al.</u> (1982) stated that marine turtles once abounded in the waters around Haiti but this was no longer the case.

Nesting season Nesting reported by Kavanaght (1984) occurred in May, July and August, possibly extending to November (Ottenwalder, 1987a).

Foraging sites Kavanaght (1984) reported foraging at Pointe-à-Gravois to Port Salut. Bacon (1981) reported frequent foraging by adults and juveniles at Gonare Island.

EXPLOITATION

Commodity Sea turtle meat and eggs are highly appreciated by the Haitians and can be found in seafood shops in Port-au-Prince. Tortoiseshell products and whole shells are regularly sold in tourist shops (Ottenwalder, 1987a).

Hunting intensity Kavanaght (1984) estimated, from exports of carapace, landings of 250 kg of <u>C. mydas</u> and 242 kg of <u>E. imbricata</u> in 1982. However,

in view of the quantity of tortoiseshell known to be imported by Japan (see Table 71) these landing figures appear to be an underestimate. Côtes de Fer, Raymond les Bains, Port Salut, and Conidon were identified as landing sites for turtles and turtle products (Kavanaght, 1984). The laws on turtle fishing are said to be largely ignored (Ottenwalder, 1987a).

Hunting methods Kavanaght (1984) reported the use of ordinary and trammel nets. "Folles" or turtle nets, harpoons and spearguns are also used, the majority of juvenile Hawksbills being caught by divers.

Domestic trade Carr et al. (1982) reported the presence of large quantities of tortoiseshell products for sale at Port-au-Prince airport; according to the shopkeepers, the shell came from local sources. In November 1982 a local dealer had whole carapaces available for US$25.40 each, and large bags of tortoiseshell at US$180 a kg. The two major shell dealers in Port-au-Prince were Messrs Chaboco and Etienne (Ottenwalder, 1987a).

International trade Japanese imports of bekko and other tortoiseshell products are shown in Table 71.

CITES annual reports for the period 1977-1985 record a considerable trade involving sea turtle products to or from Haiti; these include imports to France of 65 kg of scales; imports to the USA of 19 shells; and exports to Haiti of 100 carvings from the USA and 8405 kg of shell from the Cayman Islands. A considerable number of illegal shipments from Haiti have been seized on entry into the USA and, notably, a shipment of 8413 kg scales (origin Cayman Island) was seized on entry into F.R. Germany. Haiti is not party to CITES.

In view of the large quantities of bekko imported from Haiti by Japan, and taking into consideration the belief of Carr et al. (1982) that sea turtles are no longer plentiful in Haitian waters, it seems likely that Haiti provides a route through which Caribbean turtle products are exported to the rest of the world.

Table 71. Japanese imports of unworked bekko and other tortoiseshell (kg) from Haiti, 1959 to 1986, recorded in Japanese Customs Statistics. No imports were reported between 1950 and 1959.

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Bekko	311	0	827	2090	899	899	635	820	1016	1468	1482	1415	1415	1303
Other	-	-	-	-	-	45	52	0	0	0	8	82	568	651

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Bekko	2390	678	831	1094	1173	959	1689	1020	892	1188	1788	1988	2203	2767
Other	0	0	0	0	0	45	0	0	0	0	0	0	0	0

LEGISLATION

Fisheries law, 27 October 1978

Article 97: It is formally prohibited

(a) to fish "the tortue" and "the caret" during the months May to October

(b) to collect the eggs of turtles of all species in territorial waters, especially those of "caret" and "tortue"

(c) to capture "sea turtles" and "carets" on the beach.

Article 122: It is prohibited to export "caret" and "turtle" meat and their shells without authorisation from the Fisheries Service.

POPULATION: Chelonia mydas

Nesting sites The species occurs widely in Hawaiian waters, but nesting is almost entirely restricted to French Frigate Shoals, a 35 km long crescentic atoll in the middle of the archipelago. Small groups and single individuals nest on other islands to the north-west, namely Laysan, Lisianski, Pearl and Hermes Reef, and a few nests have been recorded on Kure and Midway (Balazs, 1980).

Nesting numbers Balazs (1980) has presented data derived from systematic tagging in the years 1973-1979 during each breeding season at French Frigate Shoals, where over 90% of C. mydas nesting in Hawaii occurs. The annual mean for this period was 180 females, with an additional estimated 20 females in total at Laysan, Lisianski, Pearl and Hermes.

Table 72. Annual number of nesting females at French Frigate Shoals, 1973-1979, data approximated from bar graph in Balazs (1980).

Year	1973	1974	1975	1976	1977	1978	1979	Mean
	145	185	210	94	200	248	180	180

Trends in nesting numbers Balazs (1980) cites evidence that numbers at French Frigate Shoals may have been much higher in former times; this includes an 1891 report that hundreds of turtles were seen basking on the beach of East Island, with ten times as many in the water, and similar evidence exists for a decline in basking numbers at Laysan and Lisianski. The maximum seen basking at French Frigate Shoals in recent years is around 20 (Balazs, 1980). If basking numbers are directly related to nesting numbers, then a rather steep decline appears to be indicated. Lesser numbers of C. mydas are reportedly found in resident foraging areas around the main islands, and a large colony which used to nest on Polihua Beach on Lanai no longer does so (Balazs, 1985b). Balazs (1980) also noted that available nesting habitat at French Frigate Shoals has been reduced by construction and beach erosion. No population trend is evident in the data collected between 1973 and 1979 (Balazs, 1980).

Nesting season The breeding season at French Frigate Shoals starts in May, reaches a peak in late June and has declined to a very low level by early August (some sporadic nesting may occur until mid-September) (Balazs, 1980).

Foraging sites Suitable feeding grounds are widespread throughout the Hawaiian Archipelago. The main food source in the area, comprising benthic marine algae, is restricted to shallow waters, typically 3-10 m in depth and to areas where light, substrate, and plant nutrients are suitable. Sheltered zones such as current-free sand bottoms, and rocky niches, typically between 20-50 m in depth, are used by resting adults. Numerous resident areas around the main island are noted and mapped by Balazs (1980). Aspects of the diet and foraging habitat were discussed by Balazs et al. (1987).

Migration Most C. mydas in Hawaii appear to reside within the group, but make reproductive migrations from their foraging grounds around the main islands, and in the north-western (Leeward) islands, to nest at French Frigate Shoals. The minimum one-way distance of each of these journeys is

around 1100 km, thus mating off the nest beaches may involve turtles separated for most of their life by some 2200 km (Balazs, 1980 and 1983). Only one tagged turtle, tagged on Midway and recovered on Wake, around 1900 km to the south-west, has been recorded outside the Hawaiian Archipelago (this individual was suspected to have been in an unhealthy condition) (Balazs, 1980).

POPULATION: Eretmochelys imbricata

Nesting sites Nesting is known to have occurred on the main islands, at Halawa Beach on Molokai, and at Punaluu, Kawa, Orr's Beach and Kalpana, all on Hawaii. Nesting is suspected at Malaekahana and Kailua on Oahu (Balazs, 1978).

Nesting numbers Little information is available, evidently only "a few" nestings have been recorded in recent years (Balazs, 1980).

EXPLOITATION

Commodity Green Turtles have been exploited for meat in the Hawaiian Islands, probably since their colonisation around A.D. 600 (Balazs, 1980). There was not much traditional usage of Hawksbill shell, though it was used occasionally for combs and fans, and possibly for medicinal purposes (Johannes, 1986). There is apparently no established tradition of collecting turtle eggs in the Hawaiian Islands. The appearance of eggs in Honolulu market in 1867 was remarked on as a rare occurrence (Balazs, 1980).

Hunting intensity So far as is known, the deliberate catch of turtles has all but ceased in Hawaii. Commercial fishing no longer occurs, although it is acknowledged that subsistence hunting may still take place in some rural locations (Balazs, 1980).

Hunting methods Balazs (1980) and Johannes (1986) have documented the traditional techniques used for hunting turtles. The commercial fishery which operated between 1948 and 1973 relied mainly on nets (49.5% of the turtles caught), with lesser quantites being caught by gaff (10.2%), scuba (5.6%), spear (3.4%), hand (2.3%) and other minor techniques (Balazs, 1980).

Historical trends The traditional use of turtles was said to have been limited by the "kapu" system, which only allowed nobles and priests to eat their meat (Balazs, 1980), although Johannes (1986) cited evidence that other sections of society also ate turtles. The kapu system broke down around 1819, after which both the local use and the commercial take by visiting vessels from Japan and North America increased, and proceeded virtually without control until 1974. Data exist for the numbers of turtles inspected and sold annually in the Honolulu fish market at the turn of the century, and these are given in Table 73. Commercial fishermen have been licensed and required to fill in catch reports since at least 1944. The recorded harvests are given in Table 73, but Balazs cautioned that these were probably underestimates, as data were missing in some years and catches were known to be higher on some islands. There were also some commercial catches on the north-western islands which were not included in these totals. The subsistence take was not recorded prior to 1974 but it, combined with the sport take, was thought to exceed the commercial take by far. From 1974 until 1977, a total of 49 turtles were said to have been taken for subsistence purposes (Balazs, 1980).

Table 73. Commercial harvest of C. mydas in Hawaii. Data for 1900-1904 represent turtles sold in Honolulu fish market (Cobb, 1905, cited in Balazs, 1980). Data for 1948-1973 are fishery catch reports (Balazs, 1980).

	Hawaii	Maui	Lanai	Molokai	Ohau	Kauai	Total
1900					184		184
1902					194		194
1903					168		168
1904					258		258
1948	0	63	1	0	54	0	118
1949	0	113	0	0	43	-	156
1950	25	1	0	17	15	-	58
1951	3	0	0	-	3	0	6
1952	0	1	0	7	19	-	27
1953	1	1	0	22	-	0	24
1954	6	2	0	15	-	0	23
1955	0	7	0	56	4	9	76
1956	0	18	0	33	2	5	58
1957	0	10	0	0	0	0	10
1958	-	31	0	0	1	0	32
1959	5	2	0	0	-	0	7
1960	0	16	19	0	0	0	35
1961	0	3	1	0	0	0	4
1962	0	0	0	0	-	0	0
1963	0	-	0	0	-	0	0
1964	1	17	0	0	2	0	20
1965	0	2	0	11	1	0	14
1966	4	1	3	-	5	0	13
1967	0	7	20	0	-	0	27
1968	99	27	1	0	0	0	127
1969	16	63	3	1	3	0	86
1970	1	73	0	0	1	-	75
1971	23	87	2	8	8	4	132
1972	0	85	0	36	43	5	169
1973	0	42	0	33	96	2	173
Total	184	672	50	239	300	25	1470

Domestic trade There is thought to have been virtually no domestic trade in indigenous turtle products since 1974. Prior to that, most, if not all, of the commercial catch was sold on the islands (Balazs, 1980).

International trade Although turtle products were exported from Hawaii in the 19th century, Balazs (1980) could find no evidence that commercial exports had taken place in the current century, concluding that all the supply had been consumed by the local market. Hawaii is a state of the USA and is therefore not recorded separately in CITES reports or Customs statistics.

RANCHING

Commercial raising of turtles on Hawaii has been suggested on several occasions, but has not been undertaken. The early Hawaiians used to use a coastal pond on Oahu to keep live turtles in until they were ready for eating (Balazs, 1980).

The Sea Life Park on Oahu has maintained turtles as an exhibit for some time. In 1974, a pool was constructed off a sandy beach to act as an experimental breeding facility, and the first nesting took place in 1976. It is thought that only four of the nine females nested. A total of 398 hatchlings were produced from these nests, of which 295 were released off Oahu while some were retained in captivity. After a further five months 24 were released. No further nesting took place between 1976 and 1980 (Balazs, 1980).

LEGISLATION

Apart from protection within the National Wildlife Refuge, there was no protection of sea turtles in Hawaii until 1974, when commercial fishing was prohibited. Turtles larger than 36" (91 cm) could be taken for "home consumption". E. imbricata and D. coriacea were totally protected. In 1978, C. mydas was included under the threatened category under the US Endangered Species Act, which has jurisdiction on Hawaii, and all hunting was prohibited (Balazs, 1980).

HONDURAS: CARIBBEAN

POPULATION: Chelonia mydas

Nesting sites Carr et al. (1982) report that Green Turtles, along with Hawksbills and Loggerheads, nest on the extensive beaches between Puerto Cortés and La Ceiba; Green Turtles also reportedly nest on Vivario, Becerro and Caratasca Cays. The Miskitia (Mosquitia) region in the east of the country has not been surveyed (Carr et al., 1982).

Nesting numbers Carr et al. (1982) stated that Green Turtles nested "regularly but not abundantly" on the aforementioned cays. Numbers (of turtles in general) nesting on mainland beaches were said to have greatly diminished (Carr at al., 1982) although no figures or estimates were available. Nesting (for the whole country) was described in 1986 as of low abundance by Portillo (in litt., 20 August 1986).

Trends in nesting numbers See above. Portillo, referring to the whole country, stated (in litt., 20 August 1986) that numbers were decreasing.

Nesting season Nesting was said to occur on the Miskitia coast during August and September (Cruz and Espinal, 1987).

Foraging sites Good developmental habitat for Green Turtles, Hawksbills and Loggerheads reportedly occurs around all the Bay Islands (Utila, Roatán, Barbareta and Guanaja), although populations in this region are said to be badly depleted. From the Bay Islands east to Cabo Gracias a Dios there are extensive seagrass flats also apparently frequented by these species (Carr et al., 1982).

Migration Until 1982 there had been 27 tag returns from Honduran waters, mostly from the eastern part of the coast, of females tagged at the Tortuguero nesting beach in Costa Rica (Carr et al., 1982).

POPULATION: Eretmochelys imbricata

Nesting sites Hawksbills, like Green Turtles, are reported to nest on the beaches between Puerto Cortés and La Ceiba (Carr et al., 1982). Cruz and Espinal (1987) confirmed that nesting occurred on the three main Islas de Bahia, the Cayos Cochinos and the islands off the Miskitia coast.

Nesting numbers The species nests in unknown though apparently depleted numbers (Carr et al., 1982). Portillo (in litt., 20 August 1986) characterised the population of the country as a whole as of "moderate abundance" and noted that the species occurred in greater numbers than Chelonia mydas. Juvenile E. imbricata are said to be the most frequently encountered species in coastal waters (Cruz and Espinal, 1987).

Trends in nesting numbers Decreasing (Portillo in litt., 20 August 1986). Fishermen in the Bahia Islands consider that the Hawksbill has declined over the past 10-15 years (Cruz et al., 1987).

Nesting season Nesting is reported between June and September (Cruz and Espinal, 1987).

Foraging sites Good developmental habitat for Green Turtles, Hawksbills and Loggerheads reportedly occurs around all the Bay Islands (Utila, Roatán,

Barbareta and Guanaja), although populations in this region are said to be badly depleted. From the Bay Islands east to Cabo Gracias a Dios there are extensive seagrass flats also apparently frequented by these species (Carr et al., 1982).

THREATS

Carr et al. (1982) state that by far the heaviest pressure on turtles in Caribbean Honduran waters comes from incidental catch in shrimp trawls. They report that shrimp fishermen admit to taking Green Turtles, Hawksbills and Loggerheads with some regularity and state that turtles were generally taken wherever they were found.

EXPLOITATION

Commodity According to Carr et al. (1982) some Hawksbills are apparently taken for their shell; this is corroborated by Japanese import statistics for bekko which indicate a substantial trade from Honduras, particularly in the period 1980-85. CITES statistics indicate that there has been considerable export of turtle leather (declared to be chiefly from C. mydas) from Honduras in the period 1979-82 (see below).

Portillo (in litt., 20 August 1986), talking of the country as a whole, states that there is subsistence utilisation of C. mydas meat; this is likely to refer to the Caribbean coast as turtle meat is reportedly not generally eaten on the Pacific coast (Cornelius, 1981). He also refers to the harvest of eggs of both species for subsistence and to supply domestic markets; this is known to occur on the Pacific coast and is likely to take place on the Caribbean coast. Cruz and Espinal (1987) confirmed that eggs are heavily collected along the Miskitia coast for subsistence purposes.

Hunting methods Most Green Turtles are caught accidentally in shrimp trawls, but three fishermen on Utila, ten on Roatan and five on Guanaja are said to set special large-mesh turtle nets. The main season for this fishery is June-September. Hawksbills are usually caught by lobster divers using hooks and gaffs, as they are easier to approach than the faster swimming Green Turtles (Cruz and Espinal, 1987).

Hunting intensity Carr et al. (1982), implied that turtles are taken wherever they are found. Cruz and Espinal (1987) reported that in Isla de Utila nobody depended exclusively on turtle fishing, but that they were caught opportunistically for the sale of shell. Most lobster fishing boats also catch turtles. The total catch of Hawksbills was estimated, from interviews with fishermen, to be around 5000 a year. However, some of these will have been caught in Nicaraguan waters. Green Turtles are mostly caught accidentally in the nets of shrimp boats, about 1000 a year being caught in this way.

Historical trends Exploitation of the Green and Hawksbill Turtles in the Bahia Islands has a history stretching back at least 300 years. Cruz and Espinal (1987) reported that the number of merchants buying tortoiseshell on the Miskitia coast had increased in the previous five years. Fishing pressure was presumably higher, as the lobster fleet had increased from 80 boats in 1977 to 180 in 1987, although the price of Hawksbill shell had decreased from around L80 a lb to L30 over the same period. This was attributed to stricter international trade controls.

Domestic trade Green Turtle meat is the main meat sold in the Bahia Islands and fetches L2 a lb (US$0.5 a kg) on Utila and L2.5-3 a lb in Roatan and Guanaja. Hawksbill meat and turtle eggs are seldom sold, but are consumed on a subsistence basis. Hawksbill shell is actively and illegally traded with little official intervention. The price paid on the Miskitia coast, L20-30 a lb (US$4-7 a kg) is much less than that on the Bahia Islands (L40 a lb) or in La Ceiba (L70-80 a lb).

International trade CITES statistics show a substantial export from Italy for the years 1978-82 of worked items of C. mydas leather originating in Honduras. Exports were to a wide variety of countries and amounted to 84 items in 1978, 1026 items in 1979 (including 50 actual skins), 10 165 items in 1980 (including 1336 skins), 4980 items in 1981 (including 498 skins) and 2111 in 1983. In 1984 Italy removed its reservation on C. mydas; no further trade is reported in CITES statistics.

Table 74 shows a substantial reported import of tortoiseshell (bekko) from Honduras to Japan in the period 1972-86. Total exports in the period were 9258 kg, 95% (8815 kg) of which were exported in the period 1980-85. This rapid increase in exports coincides with a decrease in declared exports from adjacent Nicaragua - of the 12 661 kg of Tortoiseshell exported from that country to Japan in the period 1972-86, 91% (11 570 kg) was exported before 1980. Honduras acceded to CITES in 1985 and no exports of tortoiseshell were reported (by Japan) in 1986. According to Portillo (in litt., 20 August 1986) tortoiseshell is exported both unworked and as manufactured articles. Cruz and Espinal (1987) estimated that the annual take of 5000 Hawksbills would produce 7500-22 500 lbs (3400-10 230 kg) of shell. This is higher than the exports to Japan shown in Table 74, which suggests either that the catch was overestimated or that some of the shell is exported via other countries. Some Hawksbill shell was thought to be smuggled out of the Bahia Islands to Grand Cayman.

Table 74. Imports of bekko to Japan from Honduras, reported in Japanese Customs Statistics, 1972-86.

	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86
Kg	-	316	-	38	-	71	9	9	1132	481	636	1886	2463	2217	0

It seems almost certain that the turtles supplying this trade originated in the Caribbean rather than in the Pacific; it is unclear whether they originated in Honduran waters. As noted above, some of the substantial catch attributed to Honduran fishermen may have been taken from Nicaraguan waters.

All other CITES reported exports are trivial by comparison, although 235 unspecified items of Eretmochelys, 61 carvings and one body were exported from Honduras to the USA in 1980.

HONDURAS: ISLAS DEL CISNE (SWAN ISLANDS)

POPULATION: Chelonia mydas and Eretmochelys imbricata

The Islas del Cisne (Swan Islands) lie 150 km north-east of Honduras and comprise Isla Grande (3.2 by 0.8 km), Isla Pequeña (2.4 by under 0.8 km) and Booby Cay, a small limestone islet. Little is known of turtle populations here, although in the 1950s C. mydas and E. imbricata were both said to be common and to nest on the islands. The current status of the populations is unknown although it appears from Wells (1987) that there is little suitable nesting habitat as the islands are raised reefs with limestone cliffs comprising most of the shoreline. There is a manned US weather station on Isla Grande; Isla Pequeña and Booby Cay are uninhabited (Wells, 1988a).

HONDURAS: PACIFIC

POPULATION: Chelonia mydas and Eretmochelys imbricata

There is virtually no information on the status of either Chelonia mydas or Eretmochelys imbricata. Although most of the 65-km mainland coast (within the Gulf of Fonseca) is apparently unsuitable for nesting, turtles are known to nest on several of the nearshore and generally uninhabited islands in the gulf. The Olive Ridley is apparently the principal species nesting; there is no recent information on the status of other species, although the Hawksbill definitely used to nest (Cornelius, 1981) and Carr (1948, cited in Cornelius, 1981) reported Green Turtles, Hawksbills and Olive Ridleys for sale in the market places of Tegucigalpa.

THREATS

There is reportedly no developed shrimp fishery on the Pacific coast of Honduras, although the subsistence cast net and set net fishery for finfish probably takes turtles occasionally (Cornelius, 1981).

EXPLOITATION

According to Cornelius (1981) there is no exploitation of turtles for oil, meat or leather. Eggs are, however, heavily exploited - Cornelius (1981) reported an estimate that c. 90% of all eggs were taken for commercial trade, most from Olive Ridley nests. In the 1940s such collection was apparently mainly carried out by Salvadoreans, the eggs being taken to La Union, El Salvador for sale (Carr, 1948); Cornelius (1981) implies that more recently most or all eggs were consumed within the country.

For details of international trade see HONDURAS: CARIBBEAN above.

LEGISLATION

The General Fishing Law. 29 May 1959.
Requires a permit for the export of all live specimens of aquatic fauna,

establishes closed seasons, and regulates fishery. It reportedly protects sea turtles and their eggs from commercial use.

Regulations prohibiting the capture, industrialisation and trade of the Carey Turtle. 7 March 1978.
The taking of, and trade in, Hawksbill Turtles, E. imbricata, is prohibited for an indefinite period of time.

CITES Decreto Ley No. 771 of 1979.
All commercial trade and export of wildlife is prohibited, except for a few species which may be traded under quotas. There are no quotas for sea turtles.

POPULATION

The only sea turtle species known to have nested in Hong Kong is C. mydas (Romer, 1978). Nesting was recorded by Herklots (1931, cited by Romer) on "some of the islands" near Hong Kong in July and August, and three decades later, but in the same months, specifically on Lamma Island (1961 newspaper item, cited by Romer). This last source also reported that turtle eggs were regarded by local villagers as a rare delicacy, and were sold on Lamma at 15-20 cents apiece. No reports have been received of sea turtles nesting in Hong Kong during the past decade (M.K. Cheung in litt., 8 September 1986), although live or dead individuals are occasionally reported in Hong Kong waters. There appear to be no records of the occurrence of E. imbricata in Hong Kong.

EXPLOITATION

International trade In the past Hong Kong has featured as a major entrepot for sea turtle shell trade in South East Asia. Its Customs statistics record the import, export and re-export of "tortoiseshell and waste" and the figures are given in Tables 75 and 76. Up until 1979, a large percentage of the shell imported under this Customs category was sea turtle shell (presumably mostly E. imbricata), but following a clamp-down under the newly imposed CITES controls, the trade in sea turtle shell slowed considerably, and most of the shell traded under this category was of freshwater turtles. The Hong Kong Management Authority has confirmed that the controls continue to be exercised and that all of the "tortoiseshell" traded is of freshwater turtles, although the volume of this trade has increased considerably (Luxmoore and Canin, 1985). It is notable that before 1979 the suppliers included traditional sources of sea turtle shell such as Indonesia, Kenya, Tanzania, the Philippines and the Seychelles, whereas recently, most of the shell has come from Viet Nam and Thailand, known to be major traders of freshwater turtles. In 1985 the Indonesian Management Authority reported issuing an export permit for 1000 shells of E. imbricata to Hong Kong, but it is not known whether this shipment was ever imported to Hong Kong.

Hong Kong is covered by the United Kingdom's ratification of CITES. There is little evidence in the CITES Annual Reports of a continuing trade in sea turtle shell products other than sporadic seizures of illegal imports reported by Hong Kong or of imports from Hong Kong reported by the USA. However there is evidence of a substantial trade in turtle leather. Italy has reported exporting a total of 15 257 C. mydas leather items to Hong Kong between 1978 and 1984, but Hong Kong has also reported importing considerable unprocessed skins from Mexico and Japan, totalling 700 in 1978, 3000 in 1979, 2500 in 1981, 2017 in 1982 and 1816 in 1983. From 1980 onwards, all of the skins were declared as having originated in Cayman Islands, but in view of the facts that the Cayman Islands have never reported exporting skins to Mexico, and that Mexico has a large skin industry based on wild-caught turtles, it seems most likely that the country of origin was falsely declared in a deliberate attempt to circumvent CITES controls.

Table 75. Sources of imports of "Tortoiseshell and waste" (kg), Category 291167, reported in Hong Kong Customs statistics.

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Bangladesh	0	0	0	0	0	2500	1000	0	0	190	1352	1813	0
Cambodia	8260	0	0	0	0	0	0	0	0	0	0	0	0
China	0	0	0	0	0	0	0	0	0	0	600	216	6626
India	0	0	5810	2301	0	0	0	0	0	0	0	0	0
Indonesia	6483	4691	3808	9198	75335	14064	3000	0	4500	7995	9650	9000	0
Japan	0	0	0	0	3523	755	0	0	0	0	0	0	0
Kenya	0	0	0	98	0	0	0	0	0	0	0	0	0
Malaysia	0	0	3815	4161	1750	0	0	0	0	0	0	0	0
Philippine	375	100	72	0	0	0	0	0	0	0	0	0	0
Seychelles	0	0	0	0	132	0	0	0	0	0	0	0	0
Singapore	12	1624	405	12303	1270	1050	0	2600	0	5360	5000	700	9310
Tanzania	300	1561	1478	12303	1270	0	604	0	0	0	0	0	0
Thailand	3986	859	11232	11959	20050	0	0	1578	7001	15184	13440	34579	43311
Viet Nam	7	67	0	1854	0	0	0	0	7918	7132	13597	39384	19391
Total	19423	8902	26620	42788	102275	18369	4604	4178	19419	35861	43639	85692	78638

Table 76. Destinations of re-exports and (Exports) of "Tortoiseshell and waste" (kg), Category 291167, reported in Hong Kong Customs statistics.

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Canada	0	0	0	0	0	0	0	0	0	0	144	0	0
China	4257	5221	3902	2781	3827	(300)	0	8196	7062	15489	19288	76956	31570
France	0	0	0	33	20	0	0	0	0	0	0	0	0
Italy	0	0	0	0	0	(10)	0	0	0	0	0	0	0
Japan	134	1063	1400	1662	881	2154	100	104	0	0	0	0	0
Singapore	112	100	0	0	0	(2035)	0	0	0	0	0	0	2900
S. Korea	0	0	0	0	1300	3689	900	1200	0	10020	0	2600	5775
Taiwan	0	0	2195	1996	4100	0	0	0	1500	1015	2689	2880	8116
UK	7	0	0	0	0	0	0	0	0	0	0	0	0
Total	4510	6384	7497	6472	10128	8313	1000	9500	8562	26524	22721	82436	48361

INDIA: MAINLAND

POPULATION: Chelonia mydas

Nesting sites Nesting of any significance is restricted to the state of Gujarat (Bhaskar, 1984b). Although C. mydas has been noted at sea at many points around the coast of mainland India, nesting is very sporadic, or is unrecorded, in most peninsular states. Very sparse nesting was found at several sites in Thane District of Maharashtra during a March 1983 survey (Shaikh, 1984). In Gujarat, nesting occurs sparsely along the coast of Kutch District (forming the northern shore of the Gulf of Kutch), and, locally in moderate numbers, along the southern shore of the Gulf and around the west and south coast of the Saurashtra Peninsula, eastward to Chanch (Bhaskar, 1984a).

Nesting numbers In Gujarat, Bhaskar (1984b) recorded seven C. mydas nests on a 30 km stretch of coast east from Jakhau in western Kutch, and 866 nests around the Saurashtra Peninsula (excluding islands in the Gulf of Kutch). On the Saurashtra coast, nesting was more dense on the western portion, between Okha and Veraval, than further south and east: 3.88 nests/km on a 200 km stretch in the west compared with 0.36 nests/km on a 250 km stretch in the south. The 110 km of coast between Porbander and Veraval had a mean density of 4.58 nests/km in December 1980 (504 total) and 4.2 nests/km in October 1981. A 2 km beach south of the Indian Navy Defence Security Corps station at Okha held 39 C. mydas nests on 10 October 1981 (Bhaskar, 1984b).

Nesting season According to Bhaskar (1984b) C. mydas in this region nests between July and January.

Foraging sites Whilst C. mydas appears to occur, at least sporadically, in waters around much of mainland India, feeding concentrations are known to exist in only two areas: the Gulf of Kutch in Gujarat and the Gulf of Mannar and Palk Strait between the state of Tamil Nadu and Sri Lanka. These areas also include mainland India's chief coral reefs and seagrass beds. Turtles have also been recorded close inshore around the Saurashtra coast (Bhaskar, 1984b). Annandale (1915) mentioned finding a Green Turtle in Chilka Lake whose stomach was packed with seaweed, indicating foraging areas nearby.

Migration No specific information. Bhaskar (1984b) speculates that the C. mydas population feeding in the Gulf of Kutch may be the same population that nests on the Hawkes Bay and Sandspit beaches at Karachi.

POPULATION: Eretmochelys imbricata

Nesting sites Nesting in mainland India appears to be very sparse and sporadic, although some nests are likely to go unrecorded. For example, a solitary E. imbricata nest was found on 28 December 1980 on a beach used mainly by Olive Ridley Lepidochelys olivacea on the Tirunelveli coast of Tamil Nadu (Fernando, 1983). Similarly, the species has been recorded very occasionally along the east coast of the peninsula, off Andhra Pradesh and Orissa (Kar, pers. comm., 1985) and nesting may occur sporadically. Eight animals were reported caught in a single seine net in the Sunderbans (Bhaskar, 1984c), and a single Hawksbill was observed on the beach of Bhitarkanika Wildlife Sanctuary (Kar, 1986).

Nesting numbers Nesting numbers in mainland India appear to be extremely low, and of little significance nationally or regionally.

Foraging sites Foraging numbers are thought to be generally very low, although little detailed information is available. Bhaskar (1984b) cites local fishermen's reports that the species occurs in very small numbers in Gujarat waters. The Gulf of Mannar-Palk Bay area between Tamil Nadu and Sri Lanka is the one known important feeding area.

Foraging numbers No numerical estimates are available.

EXPLOITATION

Commodity Turtles are exploited for meat, eggs, oil and, to a small extent, shell and leather in different parts of the Indian mainland. One of the most intensive areas of egg collection is in West Bengal, where the main species exploited is L. olivacea, although the eggs of other species are also eaten. In southern Saurashtra, an area of nesting predominately by C. mydas, villagers remove the eggs from every nest found (Bhaskar, 1984b).

Turtles are considered unclean by some Hindus, but the meat is eaten in places. Southern Tamil Nadu is the area where most Green Turtles are eaten. The meat is said to be rarely consumed in northern Gujarat, but it is eaten in Maharashtra and Goa. Turtles are regularly eaten on the east coast of India, but there the species is almost exclusively L. olivacea, although Hawksbills occasionally turn up in the markets of West Bengal (Kar and Bhaskar, 1982; Bhaskar, 1984b; Das, 1985). There are several reported instances of turtle poisoning documented by Silas and Bastian Fernando (1984). Most of the cases occurred in Tamil Nadu, and the species was identified as E. imbricata, although there were two recent instances where human mortality was attributed to C. mydas. In Tirunelveli District, Tamil Nadu, there is reported to be a tradition of avoiding all turtle meat except that of C. mydas, the livers and intestines of which are normally discarded (Silas and Bastian Fernando, 1984).

Medicinal uses of turtle products are also reported, and in some coastal districts the meat, fat and eggs are thought to help in the cure of lung diseases, particularly asthma (Bhaskar, 1984b).

Turtle oil is used for sealing boats, particularly in Tamil Nadu, and there is a local use of the leather of C. mydas and L. olivacea in Saurashtra for making sandals. The shell is rarely used on the mainland, although there may be a slight exploitation of E. imbricata for this purpose in Tamil Nadu (Dattatri, 1984; Kar and Bhaskar, 1982).

Hunting intensity The Gulf of Mannar is believed to be the chief area where turtle fishing is carried out, but there is little recent information on the levels. Frazier (1980a) reported that the market at Tuticorin slaughtered 20-30 turtles every Sunday, and estimated that the total harvest in this area "in recent years has probably been several thousand". In Gujarat, some 10-15 turtles were said to be sold daily towards the end of September in the fish market at Mithapur (Bhaskar, 1984b). Siraimeetan (1985) reported that turtles were caught "in good numbers off Okha coast".

Hunting methods Other than capturing nesting turtles on the beaches, the chief methods of exploitation are the use of set nets and harpoons, particularly in Tamil Nadu (Dattatri, 1984). Special tangle nets are used

in the Gulf of Mannar (Frazier, 1980a). Turtles are also captured accidentally in trawl nets, and this is probably the main method of capture on the west coast (Bhaskar, 1984b; Siraimeetan, 1985).

Historical trends The catch of turtles in Tamil Nadu increased over the first half of this century. In 1928, the total reported catch in Madras was said to be only 28 but by 1950 the catch around Krusadai Island alone had risen to 800-1000. In the late 1960s, the annual catch of turtles in the Gulf of Mannar and Palk Bay was estimated to be 4000-5000, three-quarters of which were C. mydas. Around Tuticorin in 1973, the catch was estimated to be 1500, but it has probably increased since (Frazier, 1980a). In Gujarat, sales of turtles are said to be increasing. They are mostly caught accidentally in trawls and, whereas formerly the majority were released by the fishermen, growing numbers are now being landed and sold in the fish market at Mithapur (Bhaskar, 1984b). Siraimeetan (1985) reported a similar illegal trade in this region.

Domestic trade Turtle eggs are widely sold throught coastal India, where they are 6-12 times cheaper than chicken eggs, fetching as little as 5-10 paise each. The meat sells for Rs5-10 a kg, which is under half the price of mutton (Dattatri, 1984), although Bhaskar (1984b) reported a maximum price of Rs30 a kg in Goa. In southern Tamil Nadu, Green Turtles were stored in pens in shallow water awaiting shipment by rail to markets in the coastal towns. Between 1967 and 1973, the price of live C. mydas increased by two to seven times (Kar and Bhaskar, 1982). An analysis of the prices of turtles on sale in Tuticorin Market, Madras, in 1973 showed that meat sold for US$0.48 a kg and whole turtles (45-115 cm) ranged in price from US$1.2 to US$9. The shell of E. imbricata sold at US$12-18 a kg (Frazier, 1980a). There is some trade in turtle meat in Gujarat, particularly at Mithapur (Bhaskar, 1984b). Turtles are also reported to be transported from the coastal districts for sale in Dwakara and Bombay (Siraimeetan, 1985).

International trade In the 1960s, substantial proportion of the turtles caught in the Gulf of Mannar were exported to Sri Lanka but, after this trade was stopped, the merchants in Tuticorin started selling meat to visiting ships from the USA and F.R. Germany. Between 1966 and 1974, annual exports of meat ranged from 2652 kg to 1095 kg, to a total of nine different countries (Frazier, 1980a).

India ratified CITES on 20 July 1976. CITES Annual Reports between 1977 and 1985 record the import to the USA of 100 carvings of Cheloniidae and five E. imbricata leather items from India.

Until 1975, when the export of turtle products was banned except with the approval of the Ministry of Agriculture, there was a regular trade in turtle products in and out of India. Frazier (1980a) reported that there was an annual average import of tortoiseshell from Zanzibar of 300 kg between 1891 and 1957. He cited figures which indicated that exports of tortoiseshell from India fell from 101 772 kg in 1960 to 63 kg in 1974. However these do not agree with Indian Customs export figures (reported by Wells, 1979) of domestic exports of unworked tortoiseshell, which are given in Table 77, and show exports amounting to 2455 kg in 1974. No exports have been reported in Indian Customs Reports since February 1978. Several countries have indicated, in their Customs Reports, imports of raw tortoiseshell from India, and these are given in Table 78. These figures confirm that the levels of international trade have fallen since the 1970s. The peak levels of trade, reported in 1976 and 1977 (Table 77), may have been attributable to traders attempting to clear their stocks before turtle protection controls were stepped up in 1978.

Table 77. Domestic exports of unworked tortoiseshell from India (kg). Indian Customs Export Reports, cited in Wells (1979). * April-December only. ** January-February only.

	1973 *	1974	1975	1976	1977	1978 **
Belgium	1	-	-	-	-	-
France	223	281	652	-	-	-
FR Germany	-	135	10210	60	20816	-
Greece	284	-	-	-	-	-
Hong Kong	592	-	25	8981	1134	-
Italy	615	265	215	-	1699	-
Japan	300	20	53	52	6000	2245
Kuwait	-	-	-	-	50050	-
Nepal	-	-	-	-	1500	-
Norway	-	-	658	-	-	-
Singapore	-	126	-	10000	-	-
UK	-	500	330	-	-	-
USA	-	1128	1086	2367	1656	11329
Total	2015	2455	13229	21460	82855	11918

Table 78. Imports of raw tortoiseshell from India indicated in Customs Reports of importing countries (Wells, 1979; Canin and Luxmoore, 1985).

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Hong Kong		-	-	5810	2301	-	-	-	-	-
Italy		165	177	105	-	-	-	-		-
Japan (Bekko)	1195	74	150	194	68	20	-	-	-	-
Japan (Other)	208	-	-	-	21	-	-	-	-	-
Korea, Rep. of		300	-	-	-	-	-	600	-	700
Singapore	214	-	210	40	34	548	-	-	-	-
Taiwan		-	45	-	-	-	-	-	-	-

LEGISLATION

Wildlife Protection Act, 9 September 1972.

The following species are included in Schedule 1; they are protected and hunting is prohibited:

C. caretta
C. mydas
E. imbricata imbricata
L. olivacea
D. coriacea

INDIA: LAKSHADWEEP

POPULATION: Chelonia mydas

Nesting sites Green Turtles nest on Suheli Valiakara, Tinnakara, Bangaram, Suheli Cheriakkara, Parali II and Pitti (Bhaskar, 1980 and 1984b). All these islands are uninhabited during the nesting season. The majority of C. mydas nesting on Suheli Valiakara, a 1 km by 300 m coral island near the Lakshadweep capital of Kavaratti, use a 585 m beach situated on the northern half of the island's eastern coast (Bhaskar, 1980). Nesting is only sporadic on the inhabited islands, including Minicoy. There are a further ten uninhabited islands in the group, but no information on turtle nesting is available.

Nesting numbers Bhaskar (1980, 1984b) reported the following numbers of nest pits during the 1977 season:

Suheli Valiakara	202
Tinnakara	45
Bangaram	15
Suheli Cheriakkara	13
Parali II	10
Pitti	8

During the 1982 monsoon season (study period 20 May-11 October) between 119 and 135 nests were made, with a total season's nesting female population of 22-27 turtles (Bhaskar, 1984b).

Trends in nesting numbers There is little information. Laidlaw (1903) reported that both C. mydas and E. imbricata were "exceedingly numerous".

Nesting season Most C. mydas nesting occurs during the south-west monsoon in June-September; there may be some nesting at other times of year (Bhaskar, 1984b).

Foraging sites The island of Minicoy supports a population of foraging Green Turtles. Turtles are seen around the nesting islands cited above primarily during the nesting season, and it is possible that Minicoy is the main feeding ground for these turtles outside the nesting season. Minicoy is the only island in the group where the inhabitants do not hunt turtles; the Minicoy turtles are relatively insensitive to human presence and may thus be unusually amenable to study (Bhaskar, 1984b).

POPULATION: Eretmochelys imbricata

Hawksbill nesting occurs at least on the uninhabited Suheli Valiakara, and in small numbers on the inhabited islands of Androth, Kadmat and Agathi (Bhaskar, 1984b); some nesting probably occurs on all the uninhabited islands favoured by C. mydas, but possibly mainly at other times of year. No data on nesting numbers; the annual nesting population would appear not to be large.

EXPLOITATION

Commodity Both C. mydas and E. imbricata are reportedly heavily exploited (except on Minicoy), but primarily for oil, used for caulking boats, rather than for meat, which is eaten rarely or used for shark bait. Eggs are consumed more frequently (Kar and Bhaskar, 1982). Some tortoiseshell is harvested for export to the mainland (Frazier, 1980a).

Hunting intensity Current levels of exploitation in Lakshadweep are unknown. Kar and Bhaskar (1982) said that turtles were "avidly" harpooned, but Dattatri (1984) described the exploitation as "slight".

Hunting methods Turtles are generally harpooned; though the traditional use of sailing boats is giving way to motor boats (Kar and Bhaskar, 1982). Some females are turned on the nest beach.

Historical trends There was reported to have been an important fishery for Chelonia for oil as long ago as 1922 (see Frazier, 1980a), but it is not known how the intensity compared with the present levels.

Domestic trade Prior to 1978, Hawksbill scutes were said to be sold to mainland dealers in Mangalore, fetching Rs150 a kg in the 1970s (Kar and Bhaskar, 1982). Oil sells for US$7.5 for 20 l (Frazier, 1980a).

International trade Although some shell is believed to be exported to the mainland, there is no evidence of direct international trade.

LEGISLATION

The Wildlife Protection Act (1972) (q.v.) is effective in the Lakshadweep.

INDIA: ANDAMAN AND NICOBAR ISLANDS

POPULATION: Chelonia mydas

Nesting sites Only a small proportion of the several hundred islands and islets in these groups have been surveyed for turtle nesting; on present evidence C. mydas nesting does not appear to be widespread. Nesting has been confirmed on four of 12 uninhabited Andaman islands visited: Interview, South Reef, South Brother and Snark (Bhaskar, 1984a, 1984b). In addition, the uninhabited South Sentinel Island (Andamans) is known to be favoured by nesting Green Turtles, as is Meroe in the Nicobar group (Bhaskar, 1984a, 1984b).

Nesting numbers Few data are available. Bhaskar recorded the following numbers of nest pits during his recent two-month survey in the Andamans between 16 November 1983 and 18 January 1984.

Nesting season Peak nesting is almost certainly during the south-west monsoon, between June and September, and sporadic nesting may occur throughout the year (Bhaskar, 1984b).

Foraging sites Little detailed information available, but suitable feeding habitat is widespread in the group (Bhaskar, 1984b).

Table 79. Number of C. mydas nest pits recorded on certain Andaman Islands, 16 November 1983-18 January 1984 (data from Bhaskar, 1984b)

Interview	105
South Reef	40
South Brother	37
Snark	12
Meroe	"substantial nesting"

Migration No information. Maxwell (1911) suggested that C. mydas nesting in Burma spent most of the year feeding in the Andamans and Nicobars; however, there is no direct evidence available.

POPULATION: Eretmochelys imbricata

Nesting sites Although many islands remain to be surveyed, nesting by E. imbricata is widespread in the Andamans group, and is relatively dense at a few sites. Currently there is little information on nest sites in the Nicobars; only a few suspected nests were found in a 17 January-14 March 1981 survey by Bhaskar, and four suspected E. imbricata nests were seen at Pygmalion Point on Great Nicobar (India's southern-most point) (Bhaskar, 1984b).

Nesting numbers At least 360 E. imbricata nests were noted on the 12 uninhabited islands visited by Bhaskar between 16 November 1983 and 18 January 1984 (Bhaskar, 1984a, 1984b), with nearly half of all nests on South Reef and North Brother Islands.

Table 80. Number of E. imbricata nest pits recorded on certain Andaman Islands, 16 November 1983-18 January 1984 (data from Bhaskar, 1984b)

South Reef	80
North Brother	78
South Brother	37
Snark	27
Kwangtung	27
South Cinque	20
North Reef	19
North Cinque	18
Interview	17
East Twin	13
West Twin	12
Latouche	12

Numbers are highest on islands with minimal human disturbance and where Water Monitors Varanus salvator (an avid egg predator) are absent. About 15 additional islands suitable for nesting were not surveyed by Bhaskar, and most of the believed nesting season was not covered. The estimated total annual number of E. imbricata nests in the Andamans (excluding the Nicobars) is 500-800 (Bhaskar, 1984d). This could represent 150-250 mature females.

The Andamans E. imbricata population is by far the largest in Indian territory, and is of regional importance. Less information is available for the Nicobars, but nesting appears to be relatively sparse.

Nesting season Peak nesting in the Andamans is believed to be from April to January, with some nesting throughout the year (Bhaskar, 1984b).

Foraging sites Little detailed information available, but suitable feeding habitat is widespread in the group (Bhaskar, 1984b).

EXPLOITATION

Commodity Four species of sea turtle are said to be exploited in the Andaman and Nicobar Islands for meat, eggs and shell. Most of the products are used locally (Frazier, 1980a). Bhaskar and Whitaker (1983) reported consumption of meat and eggs, but did not mention utilisation of turtle shell.

Hunting intensity There is said to be an "active" turtle fishery in the islands, and eggs are "eagerly sought" (Frazier, 1980a). Bhaskar (1980) said that on Great Nicobar, human, dog and pig predation left few clutches to hatch. Subsistence hunting by indigenous Onge tribals (a small and declining group) is at a sufficiently low level to have little or no effect on turtle numbers (Bhaskar and Whitaker, 1983). However, these authors expressed considerable concern over the mainly commercial fishery operating around South Andaman until at least the late 1970s; fishermen (of Bengali origin) reportedly may catch 5-20 turtles during fishing days, which are relatively few after the onset of the south-west monsoon in late May (most turtle nesting is said to occur in August). The Green Turtle is the main target species, and Maymyo and Wandoor on South Andaman were the main slaughter and distribution centres.

Hunting methods Turtles are harpooned, netted and caught on nesting beaches (Frazier, 1980a). According to Bhaskar and Whitaker (1983), most turtles are caught at sea, mainly by harpooning. The Onges use a wooden spear with detachable metal head.

Historical trends Maxwell (1911), writing in 1898, said that "the green turtle used to be captured in the Andamans and sent up to Calcutta in fairly large numbers some years ago and probably is so still". It is not known how past levels of exploitation compare with those found at present. The domestic fishery on South Andaman was certainly continuing in late 1978, after the ban of October 1977 (Bhaskar and Whitaker, 1983).

Domestic trade Most exploitation is for subsistence use, but some meat and eggs are transported to Port Blair for sale. Eggs sell for US$0.015 each, meat for US$0.50 a kg, and shell for US$4.00 [a kg ?] (Frazier, 1980a). Bhaskar and Whitaker (1983) do not report trade in shell, but note that meat from the fishery in South Andaman fetched Rs.3-5 a kg after transport to Port Blair, and eggs, although mainly consumed by collectors, were occasionally sold for five paise each.

LEGISLATION:

The Wildlife Protection Act (1972) (q.v.) is effective in the Andaman and Nicobar Islands.

POPULATION: Chelonia mydas

Nesting sites Nesting by C. mydas, generally regarded as the most common sea turtle in Indonesia, has been recorded at very many sites distributed virtually throughout the country. As reported by Salm and Halim (1984), nesting extends from islands off western Sumatra in the west to Irian Jaya in the east, and from islands near the border with the Philippines in the north to Timor in the south. Known C. mydas nest sites are listed in Table 81, together with estimates of nesting numbers.

Nesting numbers Available data on egg production, annual nests and female numbers are presented in Table 81 (information from Schulz, 1987 and 1989, and sources cited therein). For the vast majority of nest sites, no direct information on nesting numbers is available; however, the prevalent practice of harvesting eggs has allowed a useful, if approximate, estimate of nesting numbers to be made, based either on official harvest records, on the rental value of collection areas, or on unofficial local information. Schulz (1984 and 1987) has visited most of the sites in west and central Indonesia that had been suspected to hold large nesting populations, and has provided nesting estimates for many of them. Surveys have recently been carried out in more easterly parts of the country, including Sulawesi and the Moluccas (Schulz, 1989), but full results are not yet available.

Nesting numbers at most sites are regarded as low to moderate by Nuitja and Akhmad (1982). This appears to be confirmed by data collected during the IUCN/WWF Marine Conservation Programme undertaken in conjunction with the PHPA (Salm, 1984, cited in Schulz, 1987; Salm and Halim, 1984).

Polunin (1975) cited egg collection data relating to west Kalimantan, the Berau region of east Kalimantan, Sukabumi (near Pangumbahan and adjacent beaches) in west Java, Jember (near Sukomade) in east Java, and the Riau Islands. Very approximately nine million eggs were collected in the 1961-1962 period. Polunin calculated (on the basis of mean clutch size and mean renestings per female) that well over 30 000 female turtles, mostly C. mydas, were nesting annually in western Indonesia (Sumatra, Java, Bali, Kalimantan, and adjacent islands) at that time. Similarly, Polunin and Nuitja (1982) concluded that some 25 000 C. mydas nested annually in western Indonesia.

Salm and Halim (1984), on the basis of more extensive survey data, suggested that between one quarter and half a million C. mydas may reside in Indonesia, with many more foraging in the country but nesting elsewhere; these authors also suggest that there are between 65 000 and 120 000 nesting C. mydas present. This last estimate would imply, given a three year breeding cycle, that between 21 700 and 40 000 C. mydas nest annually. Schulz's recent fieldwork (1984 and 1987) has allowed realistic estimates to be made for nesting at sites previously unknown, and has necessitated revision of some older estimates for certain sites. The most recent estimate, based on the best available evidence (Schulz, 1987), suggests between 25 000 and 35 000 females nest annually in Indonesia; this is broadly compatible with Salm and Halim's figures.

Several sites within Indonesia hold sufficiently large nesting numbers that individually they would rank among the more important of the known world nesting beaches. These are, in west-east order:

- each of the Anambas, South Natuna and Tambelan groups (Riau Province, South China Sea),

- Pangumbahan (SW Java),
- beaches in south Kalimantan,
- the Berau group of islands, off north-east Kalimantan,
- the Aru group, notably Enu Island.

Of these, the island groups in Riau Province, the Berau group, and the Aru islands appear to hold the largest nesting populations.

Table 81. Known C. mydas nest sites in Indonesia, with estimates of eggs, nests, and nesting females per year (from Schulz, 1987 and 1989). The annual female estimate is extrapolated from recorded numbers of eggs collected or nests laid, based on the assumption of 120 eggs per clutch and three clutches per female per year (Schulz, 1987). Sources of information, referenced by numbers 1-5, are as follows: 1 = Salm, 1984; 2 = Schulz, 1984; 3 = Schulz, 1987; 4 = A. Sumantri; 5 = Director General PHPA, 1986; 6 = Schulz, 1989; numbers 1, 4 and 5 have not been seen but are cited in Schulz, 1987. One or two of the estimates for annual nesting numbers in the last column of the table differ slightly from figures given in the main text of this account, but in no case do these change the overall picture significantly. K - Kepulauan (island group); P - Pulau (island).

Location	Ref.	Eggs/year	Nests/year	Nesting females/year
Aceh and N. Sumatra Province				
	1		800 ?	200-275
Riau Province				
K. Riau and K. Lingga	3,5		100-600	200-225
K. Anambas	3	1 000 000	8 500	2 200-2 800
K. Natuna Selatan (Serasan etc.)		800 000	6 500	1 550-2 200
K. Tambelan	3	750 000	6 150	1 800-2 150
others (inc. Badas Is)	3	250 000	2 000	500-675
W. Sumatra Province				
Pasaman	1		1 000 ?	250-300
S. of Padang	4		500	125-150
P. Penyu	4		1 000-1 500	250-500
P. Pagai	1		700 ?	175-225
Bengkulu Province				
Bengkulu (inc. P. Pendek, Tikus)	4		500	125-150
S. Sumatra Province				
Belitung islands S, SW	3		100	150-200 (all islands)
Belitung other islands	3		300	
Momperang Is	3		200	
Lampung Province				
			400	100-125

Table 81 continued

Location	Ref.	Eggs/year	Nests/year	Nesting females/year
W. Java Province				
Ujung Kulon	1		450	100-150
Citirem/Cibulakan	6		350	85-115
Pangumbahan	2,3,6	400 000-600 000	3 300-5 000	900-1 600
S. coast beaches	2		200	50-75
E. Java Province				
Nusa Barung	2		200	50-75
Sukamade	2,3		650	150-225
Blambangan	3		100	25-35
K. Kangean	1		400	100-125
W. Nusa Tenggara Province				
N. Sumbawa (Ketupat)	6	100 000-300 000	825-2 500	200-800
other beaches	6		1 000	250-350
E. Nusa Tenggara Province				
	1		450	100-150
W. Kalimantan Province				
Sambas-Paloh	3	200 000	1 650	400-550
P. Temaju	3		150	40-50
Central Kalimantan				
	1		800	200-250
S. Kalimantan				
P. Samberglap (= Samaragalang)	6	500 000	4 000 (all islands)	1 000-1 350 (all islands)
P. Matasiri	6			
P. Pandangpandangan	6			
P. Birah (-birahan)	6			
Kep. Laut Kecil	6			
other beaches	1		2 000	500-600
E. Kalimantan				
Berau Turtle Is.	2		16 500 (all islands)	4 000-5 500 (all islands)
P. Sangalaki		650 000		
3 other islands:				
P. Bilang-bilangan				
P. Belambangan				
P. Sambit		1 350 000		
N. Sulawesi Province				
	1		3 000	750-1 000
Central Sulawesi Province				
	1		1 500-4 500	400-1 500

Table 81 continued

Location	Ref.	Eggs/year	Nests/year	Nesting females/year
S. Sulawesi Province	6			
Islands in S. Makassar Strait (Balobaloang Is, Masalima Is, Kalukalukuang Is			100-300	25-100
Kep. Tengah, Kep. Sabalana (Flores Sea)			100-300	25-100
Islands Salayar District (Flores Sea): Tanah Jampea, Kalao, Kalao Toa, Madu, Kayuadi, Panjang, Kep. Taka Bone Rate (= Tiger Is) etc.			600-1 500	150-500
Kep. Sembilan (Gulf of Bone) and other islands			>300	>75-100
SE. Sulawesi Province	1		1 500-5 000	400-1 650
Maluku Province	6			
Aru Islands:				
P. Enu, P. Jeh and P. Karang			<4 000	2 000-3 000
other beaches			1 000-2 000	700-250
Tanimbar Islands:				
P. Nuhu Kaha			1 000-1 500	250-500
P. Frenun			1 000-1 500	250-500
P. Yarngur Raa and Y. Rual			600	150-200
P. Riama, P. Adana, S. coast, P. Selaru, Nus Tabun, etc.			500-1 500	125-500
E. coast of P. Yamdena			500-1 000	125-350
W. coast " " "			<500	<150
Islands between Tanimbar and Timor			?	?
Kei Islands (P. Sua)			150	40-50
K. Penyu and K. Lucipara	1		2 500-5 000	800-1 650
Irian Jaya Province				
Vogelkop	1		4 000-5 000	1 000-1 650
Islands in Gulf of Chendrawasih and other beaches	1		2 500	600-800
TOTAL (rounded)			90 000-100 000	25 000-35 000

Salient features of known important *C. mydas* nest beaches, starting with the most important - islands in Riau Province, the Berau group, and the Aru Islands - are outlined below. Notes are included on habitat and exploitation, along with information on nesting numbers. Most information is taken from Schulz (1984 and 1987), also Compost (1980).

South Natuna Islands

Riau Province, including several island groups in the South China Sea region, has for some time been regarded as an important turtle area, and fishermen in north-west Kalimantan spoke of concentrations of turtles in the South Natuna and Tambelan Islands (Schulz, 1987). Both *C. mydas* and *E. imbricata* nest in the South Natuna group, including Serasan, Perhantuan and Sempadi. Schulz (1987) considered Sisi beach on Serasan Island to be one of the finest turtle nesting beaches he had yet seen in Indonesia, along with Pangumbahan and Sukamade. The main nesting season is said to be August-October for *C. mydas* and March-May for *E. imbricata*. Egg collection is intense, and while in the old days many nests would not be taken during stormy weather during the north-west monsoon (December-March), better boats and equipment now allow visits to be made throughout the year. However, a 1974 Provincial Decree prohibits turtle fishing in waters of Riau Province, and it seems that regardless of this decree, adult turtles are not taken by local hunters, nor do Balinese fishing vessels venture into the area. Fishermen have on several occasions seen *C. mydas* with tags from the Sarawak Turtle Islands (see Sambas-Paloh account below, and MALAYSIA: SARAWAK account). Egg collection data gathered by Schulz (1987) are presented in Table 82, with an estimate of annual female nesting numbers.

Table 82. Approximate annual egg harvest in the Serasan sub-district of the South Natuna Islands, with estimate of annual nesting numbers (assuming an 8:1 ratio of Greens to Hawksbills, a clutch size of 120, and three nests per female annually; data from Schulz, 1987). Post-1984 figures are omitted because incomplete.

Year	Egg harvest (3 spp.)	*C. mydas* eggs annually	*C. mydas* annual nesting number
1978	895 000		
1979	900 000		
1980	975 000		
1981	1 100 000		
1982	1 250 000		
1983	2 000 000		
1984	1 000 000		
Mean (approx.)	1 000 000	875 000	2430

Tambelan Archipelago

This isolated island group comprises some 54 islands, with turtle nesting reported to occur on almost all of the 35 uninhabited islands, but mostly on Bungin, Uwi, and Genting. Both *C. mydas* and *E. imbricata* nest in good numbers. Eggs are collected, and are sold in north-west Kalimantan when

harvests are low in the beginning of the season, but when high, during May-August, eggs are exported to Sarawak through intermediaries in the South Natuna Islands or in north-west Kalimantan. Schulz (1987) reported that virtually every egg laid was collected, representing about 800 000 eggs of both species harvested annually in the archipelago. He estimated that the C. mydas nesting population was about 2000.

Berau Turtle Islands

These comprise a group of several islands off the mouth of the Berau River in north-east Kalimantan. Pulau Sangalaki appears to be the foremost C. mydas site in the area, small numbers of E. imbricata also nest in the group. Thirty C. mydas nested on each of two nights (28 and 29 September 1984) that Schulz spent on Sangalaki. Nesting is said to occur throughout the year, with a peak in July/August to October/November. The rights are leased for egg collection on seven islands in the area; the rent for Sangalaki is almost twice as much as for any other island in the group and may thus be presumed to yield the largest egg harvest. A tender system was operated from 1934 until World War II, with collection prohibited in every alternate year; the tender system was restored in the 1950s but from the war years to the present no close season has been in force. Schulz (1984) estimated the annual egg yield in the Berau Islands as in the region of 2 000 000 eggs; using Schulz's figures of 120 eggs per clutch and three clutches per female per year, around 5 500 female C. mydas may nest annually in the group. All Schulz's informants in the area confirmed that the number of nests had declined during the last few decades. In 1943, it was not unusual for 200 turtles to nest each night, whereas in the 1980s it was unusual to see more than 25. The decline is attributed primarily to excess egg harvest, also to dynamite-fishing over the local reefs practised by overseas fishermen, decline of seaweed beds in the area (according to the locals, due to bombing of ships during the last war), and fishing by Balinese turtle boats (Schulz, 1984).

Aru Islands

Compost (1980) reported that turtles are common in waters around the Aru Islands, being frequently found in the sea channels separating the four larger islands of the group; large numbers of C. mydas nest, particularly on Enu, Karang and Jeh, with the first two being most important. According to Compost, the Aru group holds the largest C. mydas population in Indonesia. Information collected by Compost on P. Enu is summarised in Table 83. Enu, the most southerly island in the archipelago, is some 6 km by 2 km in extent, surrounded by coral reef, and has fine sand beaches along its west, south and north coasts. These beaches are, respectively, 600 m, 800 m and 700-900 m long. Some nesting reportedly occurs all year, but with highest numbers when the tide is high in the evening. Turtles are harpooned in the area, and eggs are collected; Compost (1980:22) estimated that only around 50% of the nests are taken, due in part to the inaccessibility of the nesting islands at some times of year, and the fact that the search for nests is limited to the vicinity of the boat landing place. No signs of decline in numbers of nesting C. mydas was evident to Compost and, accordingly, he considered that harvest of eggs and turtles, at its present level, posed no threat to turtle populations in the area. However, he forecast that increasing populations and industrial development in the Aru group would be likely to lead to over-exploitation in the future. A mean of 50-100 nests nightly would suggest that around 1000 females are likely to nest annually, with the total Aru annual nesting number perhaps in the low thousands.

Table 83. Nesting activity by C. mydas observed in October 1979 on Enu Island, Aru group, eastern Indonesia (data from Compost, 1980). Where observations are missing, the estimated total number of nests is calculated using the mean of the available values.

Night	Nests observed per night				
	West	South	North	Total (obs.)	Total (calc.)
14-15 Oct.	27	32	?	59	122.5
15-16 Oct.	8	19	71	98	98
16-17 Oct.	?	?	56	56	99

More recent information (Schulz, 1989) is that the Green Turtle nesting assemblage in the south Aru Islands, one of the five remaining large aggregations in Indonesia, is now acutely threatened by excess exploitation. An estimated 5 000 turtles (mainly females) are taken annually from P. Enu, P. Karang and P. Jeh by Balinese and Butongese fishermen; turtles are taken in nets set in front of the nesting beaches and in nearby internesting habitats. This volume is equivalent to between one-third and one-half of the total Bali consumption. An additional 500-1 000 turtles are killed on the nest beaches by temporary inhabitants and non-local shark fishermen. Immediate action is required if there is to be any prospect of maintaining the Aru Green Turtle population (Schulz, 1989).

Citirem

This is a beach within Cikepuh Wildlife Reserve in south-west Java. Commercial egg collection has been banned since 1981, but poaching is extensive. Good feeding habitat for both C. mydas and E. imbricata exists close offshore; significant numbers of the former species nest, and a few of the latter. Nesting figures given by Schulz (1984) are given in Table 84. Schulz suggests 400-500 C. mydas nest; this would appear to be an estimate for total numbers, the available nest figures suggest an annual contingent of some 100-200. The females nesting at Citirem are probably a component of the population nesting in greater numbers at nearby Pangumbahan beach (Schulz, 1984).

Table 84. Sea turtle nests, almost entirely C. mydas, laid at Citirem beach, south-west Java (data from Schulz (1984).

Year	1981	1982	1983	1984
Nests	797	250	271	625

Pangumbahan

This beach, 3 km in length, is located 4 km south-east of Citirem and is just outside the boundary of Cikepuh Wildlife Reserve. Schulz (1984:11) considers it to be the only remaining major C. mydas nesting beach in Java. A very few E. imbricata also use the beach. Egg collection has probably long been a local practice, but intensive (near 100%) harvest dates from some 30 years ago; a local company has bought the right to collect all eggs

laid at Pangumbahan. Schulz (1984) cited egg harvest figures quoted earlier by Polunin (1975), collected by S. Somadikarta (1961-1962 period) and Y. Muchson (1973-1974 period); these are presented in Table 85. The egg harvest has declined by more than 70% over 15 years; given that virtually all eggs laid are collected, this indicates a correspondingly severe decline in numbers of nesting turtles. It seems possible that this decline is to a large extent a consequence of the initiation of a near-100% egg harvest some 30 years ago. Schulz (1984:13) estimates the total current egg production at Citirem and Pangumbahan combined as 560 000, which suggest either that some recruitment has been occurring over the past 30 years, or that mature females have been moving into the Pangumbahan area. However, as Schulz pointed out, the current near total egg harvest cannot be sustainable, and a crash in the last important C. mydas population nesting in Java seems inevitable unless the egg harvest is very substantially reduced.

Table 85. Approximate egg harvest at Pangumbahan, south-west Java, with approximate number of nesting females, in total (from Schulz, 1984), and annually (calculated on Schulz's assumption of 120 eggs per clutch and three clutches annually per female).

Period	Eggs collected	Nesting females	
		Total	Annual
1950s	2 500 000	20 000	7 000
1967	1 250 000+		
1973-1974	509 000	4 000	1 400

Tasikmalaya

This black volcanic sand beach extends for some 10 km around the mouth of the Cilangka River in south-west Java. Reportedly, C. mydas used to nest in sizeable numbers, but nesting has declined sharply over the past 20 years (due to destruction of beach forest with subsequent erosion, excess harvest of turtles and eggs, and recreational activities on the beach); now about 100 nests are laid annually in the eastern sector and no turtles nest in the west.

Blambangan Peninsula

The nest beach at Gajagan is regularly patrolled but the more important beaches on the east coast of the Peninsula are not, and all nests are taken by local inhabitants; turtles feeding off shore are taken by Balinese fishermen. Schulz (1987) estimates that Gajagan held around 20 C. mydas nests in each year 1985 and 1986; the eastern beaches hold around 80 nests annually.

Sukamade

This beach lies within Meru Betiri National Park in south-east Java, and remains the single fully protected nesting beach in Indonesia. Four sea turtle species nest at Sukamade, with C. mydas predominant by far and very few E. imbricata. Information presented by Schulz (1985) is given in Table 86. The figures indicate a marked decline in nesting prior to protection of the area in 1980, attributed to excess harvest of eggs, and some degree of decline after 1980. Present threats include poaching, predation by wild pigs, and inappropriate hatchery procedures (Schulz, 1984); Schulz recommended that the pigs be eradicated and then the nests left to hatch naturally rather than be transplanted to a hatchery.

Table 86. Nest numbers and estimated annual female numbers (assuming three clutches per female annually) (data from Schulz, 1984 and 1987).

Year	Nests (4 spp.)	C. mydas nests (extrapolated)	C. mydas nests (counted)	Estimated annual females
1970	2072	2000		666
1971	1525	1525		508
1972	1278	1250		417
1973	1116	1100		366
1974	1924	1900		633
1975	850	825		275
1976	647	625		208
1977	875	900		300
1978	1556	1550		516
1979	850	283		94
1980	625	?		
1981	1378	1350		450
1982			807	269
1983			299	99
1984			1084	361
1985			738	246
1986			420	140

Sambas-Paloh beaches

These beaches, some 50 km in length, are located in north-west Kalimantan from the mouth of the Paloh River to the border with Sarawak. The beaches are apparently subject to rapid changes in morphology, due to erosion and deposition caused by wave action. Schulz (1987) reports that local fishermen had seen "quite a few" C. mydas on the nesting beaches with tags; these tags were probably applied while the turtles were nesting on the Sarawak Turtle Islands (see MALAYSIA: SARAWAK account), which lie some 100 km distant, around Cape Dato. Schulz received similar information in the South Natuna Islands, and concluded that nest site fixity shown by nesting females is apparently much less pronounced than in other areas. Egg harvest data, and inferred nesting numbers are presented in Table 87 (data from Schulz, 1987).

Table 87. C. mydas eggs collected on Paloh beaches, with inferred annual nesting numbers (from Schulz, 1987; assuming 120 eggs per clutch, three clutches per season)

Period	Eggs collected	Annual nesting females
May 1981-April 1982	200 215	556
May 1982-April 1983	207 330	576
May 1983-April 1984	146 600	407
Mean	185 000	513

P. Lemukutan

Although Salm (1984, cited in Schulz, 1987) listed this island as an important C. mydas rookery, with 1000-2000 nests a year, the island is heavily disturbed, and Schulz (1987) reports that fewer than five C. mydas nests have been laid annually in recent decades

Trends in nesting numbers Long-term data for specific sites are very sparse, as are precise data in general; however, the available information does suggest a general decline in nesting numbers (Polunin and Nuitja, 1982; Schulz, 1982 and 1987; Anon., 1984c).

At Sukamade beach (Meru Betiri N.P., south-east Java), for which a relatively long sequence of nesting data is available, the annual mean number of C. mydas nests was around 1433 in 1970-1975, and 783 in 1981-1986 (Schulz, 1984 and 1987). This represents a decline of about 50%. At Pangumbahan, the only important C. mydas nest site left in Java, some two and a half million C. mydas eggs were being harvested annually in the 1950s, falling to around one and a quarter million in 1967, and falling again to around half a million in the early 1970s (Schulz, 1984). The current harvest, according to Schulz (1987) is about 400 000. This represents a decline of around 80%. In the Berau Turtle Islands (north-east Kalimantan), one of the three largest C. mydas nesting areas in Indonesia, Schulz (1984) was reliably informed by local residents that it was not unusual for 200 females to nest nightly in the mid-1940s, whereas now it is unusual to find 25 a night.

The observed declines are generally attributed to excess harvest of eggs and/or of turtles, caught at sea or turned on the beach (Polunin and Nuitja, 1982; Schulz, 1984 and 1987), and, to the extent that these factors operate elsewhere in Indonesia, similar declines may be inferred to have occurred. This seems to be confirmed by the fact that fishing boats supplying the demand of the Bali turtle trade are having to travel further and further afield within Indonesia to maintain catches (Polunin and Nuitja, 1982; Anon., 1984c) The C. mydas population that formerly nested on Bali has been extirpated, and nearby stocks are depleted (Schulz, 1984). Declines have been reported in Java (Schulz, 1984), North Sulawesi and Flores (sources cited in Polunin and Nuitja, 1984). It seems likely to be more than coincidence that two of the three areas most important for C. mydas nesting in Indonesia - the Anambas, South Natuna and Tambelan island groups (South China Sea), and the Aru Islands (near Irian Jaya) - are geographically remote from the centre of the C. mydas trade in Bali. In the former island groups, although egg harvest is intense, hunting of turtles is prohibited by Provincial Decree and is little-practised - even Balinese fishermen are discouraged from operating (Schulz, 1987); in the Aru Islands, most turtle harvest is for local use and egg collection is more sporadic than elsewhere in Indonesia (Compost, 1980). However, Compost (1980) stated that exploitation, although of reasonable intensity at the time of his visit in 1979, was likely to increase to unsustainable levels with increasing development and human populations in the area; Schulz (1984) stated that Balinese and Chinese turtle boats had been reported active in the Aru group. See account of Aru Islands population (in "Nesting numbers" section above) for new information on massive exploitation of breeding turtles.

After independently assessing the best available information, both Salm and Usher (1984, referring to C. mydas in particular) and Schulz (1984, referring to turtles in general), categorically stated that turtle catch and egg harvest are far in excess of sustainable levels, and that a crash in

nesting populations is inevitable if exploitation remains at the intensity then prevailing. One additional factor is that nesting populations in Indonesia will to some extent be buffered against over-exploitation because a significant, but unknown, proportion of the turtles caught at sea will be individuals that forage in Indonesian waters but use distant nesting beaches, outside Indonesian territory (see Migration section, below).

Nesting season At some sites, such as Enu in the Aru group (Compost, 1980) and the Sambas-Paloh beaches in north-west Kalimantan - perhaps at most sites - some level of nesting persists throughout the year; at the latter, nesting is concentrated in June-September, with a peak in July-August. At Pangumbahan, nesting occurs all year round, with lowest activity in January-March. Nesting in the South Natuna Islands and in the Berau Turtle Islands is concentrated in August-October, and in the Tambelan group, in May-August (Schulz, 1984 and 1987).

Foraging sites Foraging habitat, including seagrass and algal pastures, coral reef flats and marine shallows, appears to be very widespread in Indonesia, with the probable exception of certain areas where large rivers flow into the sea, such as parts of the Sunda and Arafura shelves (parts of Kalimantan, Sumatra, Java and Irian Jaya) (Salm and Halim, 1984).

Migration No long-term tagging programmes have been undertaken in Indonesia, and migratory movements of Indonesian nesting turtles are unknown. However, several female C. mydas tagged on distant beaches have been recovered in Indonesian territory, again demonstrating that migrant sea turtle populations are often a resource shared by more than one country. Countries known to provide nesting grounds for turtles foraging in Indonesia include: Australia (tagged in Queensland, recaptured in Ambon, Aru and Irian Jaya) (Limpus and Fleay, 1983), Papua New Guinea (tagged on Long Island, 5 of 14 recaptures from north-west Irian Jaya) (Spring, 1983), Sabah (two recaptures, at Cempedek Island, south-east Sulawesi, and Kai Kechil, eastern Moluccas) (de Silva in press, 1986), and, reportedly, Sarawak. Turtles bearing tags said to be from the Sarawak turtle islands have, according to local informants reported by Schulz (1987), been recaptured on nesting beaches in the South Natuna Islands and on mainland north-west Kalimantan.

POPULATION: Eretmochelys imbricata

Nesting sites This appears to be the second most common sea turtle in Indonesia, and, as with C. mydas, nesting has been recorded at very many sites distributed virtually throughout the country. As reported by Salm and Halim (1984), nesting extends from islands off western Sumatra in the west, to Irian Jaya in the east, and from northern Sulawesi and northern Kalimantan, to Timor, in the south. Known E. imbricata nest sites are listed in Table 88, together with estimates of nesting numbers.

Nesting numbers Available data on egg production, annual nests and female numbers are presented in Table 88 (information from Schulz, 1987, and sources cited therein). For the vast majority of nest sites, no direct information on nesting numbers is available; however, the prevalent practice of harvesting eggs has allowed a useful, if approximate, estimate of nesting numbers to be made, based either on official harvest records, on the rental value of collection areas, or on unofficial local information. Schulz (1984 and 1987) has visited several of the sites in west and central Indonesia that had been suspected to hold large nesting populations, and has provided nesting estimates for many of them. Surveys are still required in some

Table 88. Known *E. imbricata* nest sites in Indonesia, with estimates of eggs and nests per year (from Schulz, 1987). Sources of information, referenced by numbers 1-4, are as follows: 1 = Salm, 1984; 2 = Schulz, 1984; 3 = Schulz, 1987; 4 = Director General PHPA, 1986; number 4 has not been seen but is cited in Schulz, 1987.

Location	Ref.	Eggs/year	Nests/year
Aceh Province	1		400
N. Sumatra Province	1		600 ?
Riau Province			
Sub-district Senayang (E, SE of P. Sebangka)	3,4	50 000	400
Other islands in S. Riau, N. Lingga	3	6 000	50
N. Riau and S. Lingga	3	12 000	100
K. Anambas	3	100 000	800
K. Natuna Besar	3	24 000	200
K. Natuna Selatan (Serasan etc.)	3	75 000	620
K. Tambelan	3		800
P. Genting		75 000	
Other islands		25 000	
Others	3	25 000	200
W. Sumatra Province	1		500 (prob. fewer)
Bengkulu Province	1		300 (prob. fewer)
S. Sumatra Province			
Belitung area	3		
P. Momperak, P. Pesambung		150 000	1 250
P. Tengah,.P. Sembilan		100 000	800
P. Gresik, P. Penyamuk		80 000	650
P. Pesemut			150
P. Momperang			250
other islands NE of Manggar			150
islands SE of Manggar			100
P. Plemah, P. Masar Tengah			350
P. Seliu			100
P. Lima			100
P. Panjang		12 500	100
other islands near Lima			100
P. Lengkuas			100
other islands around Belitung			100-500
W. Java Province			
K. Seribu	1		500 ?
south coast	3		50
Central Java Province			
K. Karimunjawa	1		300

Table 88, continued

Location	Ref.	Eggs/year	Nests/year
E. Java Province			
south coast			50
P. Gili Yang, P. Sagubing, P. Araan	1		300
W. Nusa Tenggara Province	1		750
W. Kalimantan Province			
Selimpai, Mutusan (Paloh)	3	25 000	200
other Paloh beaches	3	6 000	50
nearby islands	3		50
S. Kalimantan	1		1 000 ?
E. Kalimantan			
N. Berau Is, with others in area	2		50
N. and Central Sulawesi Provinces	1,3		250
K. Bunaken			
K. Togian			
Islands along W. coast, between Dongala and Toli-Toli			
Islands SE. of Luwuk (K. Banggai, etc.)			
S. Sulawesi Province	1,3		3 000-4 000 (5 000 ?)
Pankajene District:			
islands in S. Makassar and P. Kayadi: K. Masalima, K. Kalukalukuang, K. Mamuju, K. Dewakang			
Islands south of S. Sulawesi:			
K. Bonerate, including Taka Bone Rate and P. Kayuadi, P. Selayar, P. Sabalana			
SE. Sulawesi Province	1,3		1 000-1 500
P. Wangi-Wangi and other islands of K. Tukang Besi, P. Kabaena, P. Wowoni, P. Saponda, Sabalanka Is.			
Maluku Province			
Ternate and area, plus:			
West Irian Province (especially around Vogelkop)	1,3		5 000-6 500
TOTAL (rounded)			21 000-28 000

parts of Riau and in Sulawesi, the Moluccas and Irian Jaya. In general, because of the highly dispersed nesting pattern of E. imbricata, with small numbers nesting, sometimes on beaches more heavily used by other species, estimates of Hawksbill nesting numbers are likely to be less reliable than in the case of C. mydas.

Nesting numbers at almost all sites are regarded as low to moderate by Nuitja and Akhmad (1982). This appears to be confirmed by data collected during the IUCN/WWF Marine Conservation Programme undertaken in conjunction with the PHPA (Salm, 1984; Salm and Halim, 1984). Schulz (1987) has modified earlier figures provided by Salm (1984, not seen) on the basis of information received from turtle traders in Ujung Pandang; however, he considers the estimate of around 25 000 Hawksbill nests per year to be too low, perhaps far too low.

Schulz (1987) preferred not to extrapolate from estimates of nests per year, to number of females nesting per year, because less information is available on E. imbricata within-season re-nesting frequency than for C. mydas. If each female re-nests three or four times a year, between 5 000 and 10 000 females may be nesting annually.

Sambas-Paloh beaches

These beaches, some 50 km in length, are located in north-west Kalimantan between the mouth of the Paloh River and the border with Sarawak. The beaches are apparently subject to rapid changes in morphology, due to erosion and deposition caused by wave action. Although large numbers of Hawksbills had been reported to nest in the area, much of the reputed nesting by this species is by Olive Ridley Lepidochelys olivacea. Schulz (1987) found that although the small sized eggs of both species are officially reported as Hawksbill, the local egg collectors admit that nesting by both species occurs, apparently in the proportion of about one-fifth E. imbricata to four-fifths L. olivacea. On this basis, some 200 E. imbricata nests were laid annually in 1981-1984 on Selimpai and Mutusan beaches, and on P. Tua, all near the mouth of the Paloh River.

South Natuna Islands

Riau Province, including several island groups in the South China Sea region, has for some time been regarded as an important turtle area, and fishermen in north-west Kalimantan spoke of concentrations of turtles in the South Natuna and Tambelan Islands (Schulz, 1987). Both E. imbricata and C. mydas nest in the South Natuna group, including Serasan, Perhantuan and Sempadi, approximately in the proportion of one of the former species to every eight of the latter. Schulz (1987) considered Sisi beach on Serasan Island to be one of the finest turtle nesting beaches he had yet seen in Indonesia, along with Pangumbahan and Sukamade. Nesting habitat is good; P. Perhantuan is a typical "Hawksbill island": a small, well-vegetated and uninhabited oceanic island, with a wide coral reef and a high beach platform. The other South Natuna Islands are similar. Good feeding habitat is thus widespread, and is similarly so in the North Natuna group, although here there is little nesting and the local feeding E. imbricata are suspected to nest in the South Natuna group (Schulz, 1987). The main nesting season for E. imbricata is said to be March-May. Egg harvest data indicate a yield of around 125 000 E. imbricata eggs annually, and (given the assumption of a mean clutch size of 120) around 7 500 nests (Schulz, 1987).

Egg collection is intense, and while in the old days many nests would not be taken in stormy weather during the north-west monsoon (December-March), better boats and equipment now allow visits to be made throughout the year. The local egg harvest contractor had already collected 4000 E. imbricata eggs (perhaps 33 nests) in the week prior to Schulz's visit (14 February 1987); this is before the main nesting period for the species. A 1974 Provincial Decree prohibits turtle fishing in waters of Riau Province, and it seems that regardless of this decree, adult turtles are not taken by local hunters, nor do Balinese fishing vessels venture into the area.

Tambelan Archipelago

This isolated island group comprises some 54 islands, with turtle nesting reported to occur on almost all of the 35 uninhabited islands, but mostly on Bungin, Uwi, and Genting. Both E. imbricata and C. mydas nest in good numbers, one or two of the former to every ten of the latter. On this basis, some 80 000 to 160 000 of the approximate annual yield of 800 000 eggs would be from E. imbricata, representing around 666 to 1333 nests. Pulau Genting, where females often nest in the brown grassy sand among coconut palms, is reported to hold highest Hawksbill nesting numbers in the Tambelan group, and six had nested on the night before Schulz's visit on 18 February 1987.

Eggs are harvested commercially, and are sold in north-west Kalimantan when harvests are low in the beginning of the season; but when high, during May-August, eggs are exported to Sarawak through intermediaries in the South Natuna Islands or in north-west Kalimantan.

Anambas Archipelago

An island group in the north-west sector of Riau Province; E. imbricata and C. mydas both nest, suspected to be in the ratio of one of the former to ten of the latter; given an annual egg harvest of more than 1 000 000 eggs, there may be more than 800 E. imbricata nests and some 100 000 eggs (Schulz, 1987).

S. Riau and N. Lingga groups

Islands off the north-west coast of Sumatra, where some 50 000 E. imbricata eggs are laid annually in the sub-district Senayang, representing around 400 nests, almost one quarter of which are laid on P. Ileuh (Schulz, 1987).

The Belitung area

The Belitung region, specifically the islands off the west and south coast, and to the east, has long been cited as important for E. imbricata nesting. The area provides excellent Hawksbill habitat, with many small and uninhabited islands, and abundant coral reefs. Nesting occurs from February to July, with a peak in March-May, and sporadic nesting throughout the year. Nesting numbers are said to be highest on P. Plemah, where up to 5-7 females may nest nightly, with an average of around four nightly during the peak period March-May (Schulz, 1987). In the Lima islands, numbers are said to be highest on P. Lima itself, with up to 5-10 nests nightly (on a good night in peak season); on P. Panjang, around 12 500 eggs a season are collected, representing some 100 nests, and diffuse nesting occurs on others in the group (Schulz, 1987). Significant numbers also nest on at least nine islands in the Momperang group, east of Belitung; The harvest is around 150 000 E. imbricata eggs (some 800 nests) on P. Momperak and and

P. Pesambung, and perhaps 3000 nests are laid annually on the remaining islands in the group.

There is no formal tender system operating for egg collection, but collectors visit nesting beaches during the season whenever nesting numbers make a visit worthwhile; eggs are consumed or sold in coastal villages or on Belitung itself, although prices seem to be very low and demand not intense. Schulz (1987) formed the impression that significant numbers of Hawksbill nests, particularly on the more remote islands, are left undisturbed. The area is hunted by Buginese fishermen who collect turtles for trade in Bali (Schulz, 1987); and the Momperang Islanders complain about frequent raids made by armed fishermen from Jakarta, who kill nesting turtles and dynamite reefs.

South-west Sulawesi

Hawksbill-rearing operations exist on three of the numerous islands west of Ujung Pandang, apparently using eggs or hatchlings obtained from nesting beaches on islands south and south-east of Sulawesi (Schulz, 1984). Schulz was able to visit one such source-island, P. Panambungan, where nesting is reportedly sparse - some 40 nests annually. No information is available on conditions on the majority of islands in this region.

North-east Kalimantan: the Berau Turtle Islands

Significant numbers of E. imbricata occur in north-east Kalimantan, judging by Schulz's (1984) estimate that more then 2000 are harvested annually in the area. Although vast areas of coral reef exist, nesting appears to be rather sparse; Schulz (1987) suggests around 50 nests annually. The harvest may thus be directed primarily at foraging turtles, whose nesting grouds are as yet unreported.

Trends in nesting numbers As noted above, estimates of the E. imbricata nesting population in Indonesia are less reliable than for C. mydas; nor are any long-term data on nesting numbers available. In these circumstances, although a decline in numbers is suspected (Schulz, 1984; Polunin and Nuitja, 1982), evidence is insufficient to substantiate this in detail. According to Schulz (1984) turtle traders did admit to a sharp decline in the availability of heavy tortoiseshell scutes, and of the highly sought-after "blonde" shell, both of which were obtained mainly in waters around Irian Jaya. According to Compost (1980), Hawksbill populations in the Kai and Aru Island groups have decreased rapidly owing to hunting for tortoiseshell. No comparative nesting data are available and this report is based on information from fishermen and traders, who stated that shells from adult animals have become rare and most Hawksbill caught are juveniles (in this context "juvenile" may refer to non-adult turtles in general).

Nesting season Most E. imbricata nesting at Sambas-Paloh (north-west Kalimantan) appears to be in January-June (although some of this nesting is by Olive Ridley Lepidochelys olivacea), most nesting in the South Natuna Islands is in March-May, and in the Belitung area in February-June (Schulz, 1987).

Foraging sites Suitable foraging grounds, notably coral reefs shallows, are widespread in Indonesia. Fringing reefs form an almost continuous strip along the clear-water coasts of Sulawesi, the Moluccas, Irian Jaya, the Lesser Sundas, Bali, Mentawai, Belitung, Lingga, and the Riau Islands; there are also patch reefs, notably in the Seribu and Spermonde groups, and off

Ujung Pandang; and barrier reefs east of Kalimantan and around the Togian Islands of Central Sulawesi (Salm and Halim , 1984). There are few atolls (although one, Taka Bone Rate, is the third largest in the world) (Salm and Halim, 1984).

THREATS

Over-exploitation of eggs and of turtles is the clearest and most prevalent threat to nesting populations. Schulz (1984) reported that destruction of beach vegetation, followed by erosion of beaches, and general disturbance, had caused the loss of nesting turtles along much of the south Java coast. Schulz (1984) also reported that the spread and increase of human coastal settlement in recent decades, following extensive habitat destruction in colonial times, will have increased the exploitation pressure on turtle populations. Other factors, such as sand mining and dynamite fishing, have also been cited as threats in certain areas.

EXPLOITATION

Commodity The eggs of all species of sea turtle are collected and eaten throughout Indonesia. Meat is eaten in some regions but not in others. C. mydas is the preferred species for eating, but the flesh of E. imbricata which have been harvested for shell is not generally wasted, though there are local traditions that it is toxic (e.g. the Aru Islands (Compost, 1980)). The shell of E. imbricata is used in the manufacture of jewellery and is exported. There is a major trade in stuffed juvenile turtles (both C. mydas and E. imbricata) and in larger polished carapaces of C. mydas. Leather of turtles which have been killed for eating is also preserved, mainly for export, and oil is extracted for use as a skin treatment and for its reputed beneficial effects on the sexual organs (Anon., 1984c).

Hunting intensity Known levels of egg harvest have been discussed in the preceding sections. As a result of his recent work, Schulz (1987) considered that he had earlier (Schulz, 1984) underestimated the levels of egg harvest, and concluded that "every egg laid is taken" in "virtually every nesting place in Indonesia, however small and far-off it may be". Moreover, this does not only involve eggs of Green Turtles, but applies equally to those of the Hawksbill (and Olive Ridley and Leatherback)".

The consumption of turtle meat is concentrated in Bali, where there is a substantial market for the commodity, but the turtles to supply this trade are taken from distant waters, even as far off as Irian Jaya. Over 5000 adult turtles are said to be obtained from the Aru Islands (Schulz, 1989). The declared landings in Bali in 1986 were 14 200 large turtles, but there was an unquantified additional number of smaller turtles, caught primarily for stuffing, the meat of which was also eaten. However Schulz (1987) cautioned that turtle meat was also consumed in other parts of Indonesia, particularly North Sulawesi, Nias, Ambon, and elsewhere. The annual consumption in Ujung Pandang was estimated to be over 1000 C. mydas, and the practice of eating turtle meat was thought to be spreading as transmigrants from Bali moved to other areas. The estimated harvest of large C. mydas in the whole of Indonesia was tentatively put at over 25 000 a year (Schulz, 1987). See account of Aru Islands population (in "Nesting numbers" section above) for new information on massive exploitation of breeding turtles.

The harvest of adult E. imbricata for shell production is more difficult to estimate, and is probably best derived from the international trade figures, on the assumption that most of the shell collected is exported and most goes to Japan, with lesser ammounts to Singapore, Korea and othe destinations in South East Asia.

Historical trends The history of the landings of live turtles at Bali has been documented (Anon., 1984c), and the annual landings since 1969 are given in Table 89. It should be noted that these are only large turtles, the smaller ones not being registered. The landings show a more or less steady increase to a peak in 1978, followed by a decline since then. This pattern was interpreted (Anon., 1984c) as a growing harvest to meet a growing demand up until 1978, followed by falling harvests caused by declining turtle populations. The size of turtles landed has progressively decreased, and fishermen reported having to travel further each year to catch large animals. In 1984, most of the adult turtles came from Irian Jaya and eastern Sulawesi (Anon., 1984c).

There is less information regarding the trends in harvest of E. imbricata. Uchida (1979) cited several fishermen who complained that Hawksbills were becoming rare and large animals more difficult to catch. The average size of shells landed was said to have decreased markedly around both Bali and Ujung Pandang.

Table 89. Numbers of live turtles landed at Tanjung Benoa (Bali) from 1969 to 1986. Data 1969-1983 from Anon. (1984c), 1984-1986 from Schulz (1987).

Year	Landing	Year	Landing
1969	9628	1978	30121
1970	13195	1979	21080
1971	15342	1980	21331
1972	14892	1981	22590
1973	17424	1982	29765
1974	22032	1983	17088
1975	18630	1984	15200
1976	25554	1985	10600
1977	26399	1986	14200

Domestic trade In some areas, such as the Aru Islands (Compost, 1980) and parts of southern Java (Schulz, 1987), eggs are harvested mainly on a subsistence basis. However, in many regions, the rights to collect eggs are put out to tender. The proceeds from these tenders are paid to local government, and represent a substantial income. Schulz (1984 and 1987) quoted estimates of the harvest together with the costs of licences to collect eggs, and these are given in Table 90. The total revenue from these five areas is about Rp250 million a year (c. US$220 000). The average value of the licences is about Rp40-50 per egg, but two areas stand out as exceptions. The first is Pangumbahan beach, Java, where a single contractor has negotiated a monopoly with the local government to collect eggs at a third of the normal rate, in spite of having low overheads (no boat transport needed, proximity to local market for eggs, etc). The same

contractor is reported to exercise despotic control over access to the beach, refusing to allow even PHPA staff to enter on occasions. The other exception is on the South Natuna Islands, where the total revenue is about twice as high as normal. This may indicate that the egg harvest has been underestimated, or it may be because some 70% of the revenue was negotiated underhand (Schulz, 1987).

Table 90. Estimated egg harvests and the revenue accruing to local government from egg collection licences (Schulz, 1984 and 1987).

Location	Estimated harvest	Revenue Rp million	Equivalent Rp/egg
S. Natuna	1 000 000	72	72
Tambelan	800 000	32	40
Berau	2-3 000 000	128	52
Pangumbahan	400 000	6	15
Paloh/Sambas	200 000	10	50

Most of the turtles landed in Tanjung Benoa, Bali, (about 400 t of turtle meat a year) are consumed in the Badung district of southern Bali. This represents about 3% of the total quantity of meat (beef, pork, chicken) consumed in the area. Turtle meat varied in price in 1984 from Rp1200 to Rp1500 (US$1.2-1.5) a kg, which is considerably cheaper than pork (Rp2000 a kg) or chicken (Rp1750 a kg), apparently because the public does not value the meat highly, and only buys it because it is cheap. Most of the turtles are slaughtered and sold by a relatively small number of merchants, some of the richer ones of whom own their own boats. The cost of large turtles at the port was said to be about Rp40 000 (US$40), which was said to be barely the retail value of the meat. Under these circumstances, sale of the skins, carapaces and other products provides most or all of the profit (Anon., 1984c).

Some 5000 C. mydas, mainly female, are taken annually from the vicinity of nest beaches in the south Aru group; this amounts to between one-third and one-half of the total Bali consumption (Schulz, 1989).

A significant proportion of meat in Bali is taken from small turtles (both C. mydas and E. imbricata) which are primarily designed for stuffing. In June 1984 alone, about 1900 small turtles were slaughtered in Tanjung Benoa and Sesetan. Some are stuffed on Bali but most are sent in a semi-preserved state (skin and carapace soaked in formalin and packed in plastic bags) to Ujung Pandang for final processing. The cost of stuffed turtles in Bali was Rp15 000 (US$15) or more, and most were sold to domestic and foreign tourists (Anon., 1984c).

Turtle leather is preserved initially by salting the skins, when it was valued at Rp4500 a set in 1984. There was some domestic trade in skins, but most was destined for export (Anon., 1984c). The export trade has since been curtailed (see below).

Relatively few large Hawksbills are landed in Bali, and of those that are, the majority of the shell is sent to Jogjakarta for the manufacture of

jewellery. Most of the tortoiseshell trade occurs in Ujung Pandang, whence it is exported (Anon., 1984c).

International trade Indonesia acceded to CITES on 28 December 1978, and in spite of the fact that it hold no reservations for any species of sea turtle, has reported substantial quantities of exports since 1980. These are shown in Table 91. The Indonesian Annual Report to CITES is compiled by PHPA, and the quantities recorded appear to correlate relatively well with the numbers of export permits issued for turtle products as reported by Anon. (1984c) and Schulz (1987). Information collected by Schulz (1987) makes it clear that, in 1985 at least, "shells" refers to kg of shells, and "bodies" refers to stuffed animals. During 1986, no exports permits were issued for C. mydas, and only one permit was issued to export 1000 stuffed E. imbricata to Japan (Schulz, 1987). Various countries have reported imports of small quantities of shells (mostly illegal or as personal possessions) but these have been omitted from the table.

Indonesian Customs statistics also record the export of "Tortoiseshell and waste" and "Worked and art of tortoiseshell". These figures are shown in Tables 93 and 95, and they appear to indicate a far greater level of trade than has been officially covered by permits issued by PHPA. Some of the raw tortoiseshell may refer to shell of freshwater turtles, which are harvested in Indonesia and exported to several oriental countries such as Hong Kong, Taiwan and probably also Singapore. However this possibility was not mentioned in Anon. (1984c) although the research had included a study of the original export documents, and it would presumably have found some evidence of freshwater turtles being involved in the trade. Anon. (1984c) investigated the discrepancy between the two sets of export figures, and concluded that in some cases, exports of sea turtle products had taken place without being recorded in the statistics and without having had export permits issued by PHPA. In one case, it was possible to ascertain that the local PHPA office in Ujung Pandang had been in complicity with the exporter to issue an export permit contrary to the instructions of PHPA Headquarters in Bogor.

The majority of turtle products are exported from Ujung Pandang, with most of the remainder from Jakarta and Surabaya, on Java (Table 94). There is some confusion as to what the two different Customs categories refer to. Of 12 739 kg of "Tortoiseshell and waste" (Category 0509200) exported from Ujung Pandang in February 1984, only 688 kg (5%) was raw tortoiseshell (i.e. scutes of E. imbricata), while the remainder comprised small, stuffed turtles. However, since 1978, Palembang has only exported turtle products under the category of "Worked and art of tortoiseshell" (Category 9505100), and this is known to include stuffed turtles (Anon., 1984c). It seems likely that most, if not all, raw tortoiseshell scutes would be classified under Category 0509200, but that stuffed turtles may fall under either category, depending on the port of export.

Even if the commodities exported under the different Customs categories can be determined, it is still more difficult to determine the quantities of turtles involved. A sample of 12 051 kg of stuffed turtles exported from Ujung Pandang had a mean weight of 1.8 kg per animal; and a shipment of 100 kg of shell comprised 1376 "sheets", assumed to represent the scutes from 106 animals, and therefore giving a mean shell weight of 0.94 kg per animal (Anon., 1984c). Analysis of the size of scutes received from Indonesia by Japanese tortoiseshell dealers revealed that, from a total of 4696 kg comprising scutes from 5957 turtles, the mean weight of scutes from each turtle was 788 g (Milliken and Tokunaga, 1987).

Some confirmation of the export figures can be found in the Customs reports of imports of tortoiseshell from Indonesia reported by the importing countries. These are shown in Table 96. Japan reports imports of "bekko" separately, and this category is known to comprise only raw Hawksbill shell and to exclude stuffed animals. Comparison of these figures with the exports to Japan shown in Table 95 shows relatively good correlation up to 1975 but rapidly increasing and much higher Indonesian exports in all subsequent years. This probably indicates either the onset of an export trade in stuffed turtles from Indonesia to Japan or the date at which the stuffed turtles started being included in Category 0509200. Japanese imports of bekko seem to have been running at about 2-6 t a year since 1971, with marked peaks in 1973 and 1977-79. These were attributed to the holding of the Washington Convention and Indonesia's accession to CITES, respectively. Japan also reports importing three other categories of tortoiseshell products in its Customs statistics: "Tortoiseshell claws and waste (excluding bekko)", "Worked bekko and articles thereof", and "Worked tortoiseshell (other than bekko) and articles thereof". Milliken and Tokunaga (1987) confirmed that these corresponded respectively to raw shell of C. mydas, stuffed E. imbricata and stuffed C. mydas. Very few other products were included in imports from Indonesia reported under these Customs categories. The average weight of bekko imported from Indonesia (788 g) indicates that bekko from a total of 17 612 large E. imbricata was imported between 1984 and 1986. The average size of the stuffed animals is less well determined, but for E. imbricata it appears to be in the region of 1.3 kg per animal and for C. mydas, about 2.3 kg. Thus the 93 052 kg of worked tortoiseshell and 42 610 kg of worked bekko imported directly from Indonesia between 1984 and 1986 would correspond to 40 457 C. mydas and 32 777 E. imbricata. Japan also reports substantial quantities of imports of tortoiseshell products from Singapore, and it is believed that most of these represent turtles acquired in Indonesia (Milliken and Tokunaga, 1987). No worked shell has been reported to be imported from Singapore between 1984 and 1986, but imports of unworked bekko ammounted to 9259 kg, which would represent shell from 11 750 large E. imbricata. Thus exports to Japan alone between 1984 and 1986 represent an average annual harvest of 9787 large E. imbricata, 10 926 small E. imbricata and 13 486 C. mydas in Indonesia.

Of the other countries to which Indonesia has reported exporting turtle products, only Hong Kong and Taiwan provide adequate Customs import statistics. The trade with Hong Kong exhibits marked fluctuations, and it is difficult to discern a pattern. From 1974 to 1984, Indonesia reported exporting a total of 245 t of raw tortoiseshell and 62 t of worked shell to Hong Kong, while Hong Kong only imported 148 t of raw shell from Indonesia. Additional worked shell may have been imported, but Hong Kong's Customs categories do not separate this commodity. While Hong Kong undoubtedly used to import turtle shell from Indonesia, the CITES Management Authority has informed us that in recent years none has been legally imported. Thus, shell reported under Customs Category 291167 is said to represent the shell of freshwater turtles (Luxmoore and Canin, 1985). However, in 1985, an export permit for the export of 1 t of E. imbricata shell to Hong Kong was issued by PHPA (Schulz, 1987). The imports to Taiwan are considerably higher than the exports reported by Indonesia, and according to import statistics the Republic of (South) Korea was a major importer, but it does not feature at all in the export statistics. Trade with these two countries may therefore have been routed via an intermediate port (such as Singapore or Hong Kong), which may have featured as the destination in the Indonesian export statistics.

Even allowing for the fact that some of the tortoiseshell reported in the Customs export statistics may not represent sea turtle material, it seems that at least 13-20 t of raw Hawksbill shell and some 30-50 t of stuffed turtles may be exported each year. This would represent a harvest of over 10 000-15 000 large Hawksbills and 25 000-50 000 small turtles.

Turtle skin is the other commodity which is known to be exported from Indonesia, mostly from Surabaya and Ujung Pandang. Its export from Bali was prohibited, but Customs officials in Surabaya were reported not to recognise it as deriving from marine turtles and therefore not to require export permits (Anon., 1984d). Formerly most of the skin used to be exported to France, Italy and Japan, but the strengthening of European import controls since 1984 has meant that exports to Europe have become considerably more difficult for the traders to arrange (Schulz, 1987). Imports of turtle skin to Japan have been recorded in Japanese Customs statistics since 1976, and the volumes are shown in Table 92. Some skins imported from Singapore probably originated in Indonesian waters, and so these figures are also given. Schulz (1987) surmised that Surabaya and Jakarta were still the main ports from which turtle skins were exported. He was unable to obtain any indications of the level of trade, but the fact that European imports appear to have been curtailed and that Japanese imports have dropped indicates that the volume may have declined.

While it is certainly true that the export of marine turtle products is still continuing at an alarming rate and constitutes a major threat to the survival of the wild populations, there are some encouraging signs that some attempts to control the trade are beginning to be effective. Largely as a result of measures taken by PHPA to tighten export controls, the imports to Japan of raw bekko, stuffed Hawksbills and turtle skins all showed marked declines in 1986. Some of the trade may have been diverted via Singapore, as Japan's imports of bekko from there nearly doubled in 1986, but this increase does not compensate for the drop in imports direct from Indonesia.

LEGISLATION

- D. coriacea is protected under Decree No. 327/kpts/um/5/1978.
- L. olivacea is protected under Decree No. 716/kpts/um/10/1980.
- C. caretta is protected under Decree No. 716/kpts/um/10/1980.

The export of protected animals is prohibited. C. mydas and E. imbricata may be exported under permits issued by PHPA

There are several local regulations issued at the provincial or district levels, and Schulz (1984) reported that these regulations were in the process of being catalogued.

RANCHING

Various ranching activities have taken place in Indonesia, some directed towards head-starting and release of juvenile turtles and others towards the commercial production of small turtles for meat and for the stuffing industry. There are probably many small-scale operations on a variety of islands, but the main documented ones are summarised below.

Bali

A pilot project to rear C. mydas was initiated by PHPA in 1981 under the title of "Bali Green Turtle Breeding Project". Eggs were obtained from Pangumbahan in Java, and the hatching percentage rose from 4.6% in 1981 to 82% in 1985. A total of 8669 turtles were hatched between 1981 and 1985 (Atmosoedirdjo, 1986). Some were released to the sea and about 1000 were used in breeding experiments (Schulz, 1984). The operation was terminated in 1985 (Schulz, 1987).

A private company (PT Bukit Vihara Mas) was granted a licence to purchase eggs from Pangumbahan, and 4900 were obtained in 1986. Some of the hatchlings were released into the sea, while the remainder were distributed to villagers around Serangan for on-growing. It was intended to repurchase the young turtles after 6-12 months and to rear them in a pond connected to the sea (Schulz, 1987). Limpus (1986) reported that over 100 families each received five hatchlings which they reared in very unsatisfactory conditions.

A further research project is carried out at Gondol, on the north coast, also using eggs from Pangumbahan (Schulz, 1987).

South Sulawesi

A ranch was operated by C.V. Sentosa at Buntolu, 30 km south of Ujung Pandang. It comprised a large fenced-off area of sea and contained 200 large C. mydas and 20 E. imbricata in 1984 (Schulz, 1984). The ranch closed in 1985 (Schulz, 1987).

C.V. Sanida started a large ranch in 1984 on P. Penambungan. Eggs are collected locally and the hatchlings are farmed out to a number of villagers on the surrounding islands for about six months, after which they are repurchased and reared in a large enclosure. The total stock amounted to about 3000 hatchling E. imbricata in March 1987 (Schulz, 1987).

A large number of local fishermen rear juvenile Hawksbills on islands around Southern Sulawesi (like P. Balang Lompo, P. Balangtjadi, P. Sanane and other islands of the Spermonde archipelago, and on P. Kalu-Kalukuang, K. Sabalana, K. Tengah). Eggs are collected locally and the hatchlings are reared in plastic and wooden basins until they are large enough to sell in Paotere for stuffing (Anon., 1984d; Schulz, 1984). One "relatively large-scale" operator on P. Balang Lompo was said to have 300 hatchlings (Anon., 1984d). This "cottage industry" was still operating in 1987 (Schulz, 1987).

Sumatra

C.V. Bintang Sakti received a permit to start a Hawksbill ranch on P. Telo, near Nias Island in 1985. The permit stipulates that 10% of the hatchlings be liberated. In October 1986 a total of 420 5-month Hawksbills and 720 12-month Hawksbills were kept in two 25-sq. m tanks. They are reared for about a year to a size of 30-35 cm after which they are sold for stuffing (Schulz, 1987).

Billiton Islands

A cottage industry of rearing Hawksbills for sale in Singapore was operating at P. Kalimambang and Tanjung Rusa in 1980, but this activity was terminated "a few years ago" (Schulz, 1987).

Java

Hawksbill rearing operations were carried on in the Seribu Islands in the Bay of Jakarta in the 1970s, but were discontinued owing to problems with disease (Schulz, 1987).

Table 91. Exports of turtle products from Indonesia recorded in CITES Annual Reports. All were recorded as exports by Indonesia, except figures in brackets, which were recorded as imports by Italy. S - shells, B - bodies.

Importer	1980	1981	1982	1983	1984	1985
Cheloniidae						
FR Germany	1614 B					
Japan	1191 B					
<u>E. imbricata</u>						
FR Germany		292 B	? S			
Hong Kong						1000 S
Japan		1430 B	3107 S	750 S		5592 B 8665 S
Netherlands						2 B
Singapore						350 S
<u>C. mydas</u>						
Italy	(600 kg S)	1650 kg S (1850 scales) (400 kg S)	850 S	500 kg S	1150 kg S	
Japan		300 B	2150 S	350 S	1000 B 500 kg S 2000 skins	12955 B
Singapore		1000 skins	450 S		2300 kg S	

Table 92. Imports of turtle skins from Indonesia and Singapore reported in Japanese Customs statistics (kg).

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Indonesia	145	6261	3018	4160	7585	20587	14759	13737	10369	2025
Singapore	0	9673	10981	8660	0	2667	0	0	0	0

Table 93. Destinations of exports of "Worked and art of tortoiseshell" (C.C.N. 9505100) reported in Indonesian Customs statistics (kg).

	1975	1976	1977	1978	1979	1980	1981	1982	1983	TOTAL
Australia	–	274	181	233	–	–	–	–	–	688
Belgium	–	23	19	269	120	0	0	0	0	431
Canada	–	1–	–	–	–	–	–	–	–	1
FR Germany	–	–	–	7	95	–	340	–	–	442
France	–	–	–	66	66	25	81	–	–	957
H. Kong	3965	2152	5810	25369	369	29704	6000	170	–	73539
Italy	240	400	604	200	0	575	800	130	–	2949
Japan	10940	50773	74350	47150	107554	76952	23287	6128	14159	411293
Malaysia	–	–	140	–	–	–	–	–	–	140
N'lands	3	550	0	30	0	–	–	–	–	583
S Korea	–	–	–	–	35	–	–	–	–	35
S'pore	8021	14803	9688	16575	36417	26703	7910	400	1130	121647
Switzerland	–	–	–	–	31	–	–	–	–	31
Taiwan	–	80	–	2200	–	–	–	–	–	2280
USA	–	–	–	–	191	–	–	–	–	191
Total	23169	69056	90792	92099	144878	133959	38418	6828	15289	

Table 94. Percentage by weight of "Tortoiseshell and waste" (C.C.N. 509200) exported through different Indonesian ports of export (from Anon., 1984c).

Port	1978	1979	1980	1981	1982	Overall
(Medan)	2.0	4.5	0.5	0.6	0.0	1.3
(Jakarta)	16.7	18.4	16.7	11.5	22.1	17.5
Surabaya	33.7	13.7	45.7	22.5	18.1	27.2
(Bali)	–	0.3	–	–	0.1	0.1
Pontianak	0.3	2.6	0.7	–	–	0.9
(Ujung Pandang)	46.6	60.4	36.3	65.4	59.6	52.0
Palembang	0.3	–	–	–	–	0.1
Banjarmasin	0.3	–	–	–	–	0.1

Table 95. Destinations of exports of "Tortoiseshell and waste" (C.C.N. 509200) reported in Indonesian Customs statistics (kg).

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Australia	–	–	–	–	–	–	–	–	–	953	381	–	6	–	200	–	–	–	–
Belgium	–	–	–	–	–	–	–	–	–	–	246	–	–	–	–	–	–	–	–
C. America	–	–	–	–	–	30	–	–	–	–	–	–	–	–	–	–	–	–	–
Denmark	–	–	–	–	–	–	–	–	–	–	–	–	5	–	–	–	–	–	–
FR Germany	–	–	–	–	–	–	–	–	–	–	–	65	–	–	–	882	–	–	–
France	–	–	–	–	–	–	–	–	–	–	156	–	328	96	–	150	575	80	–
H. Kong	2045	–	–	4228	6887	8330	6475	7116	3820	5574	1127	125008	21633	17777	6260	8313	1550	6650	40296
Italy	–	–	–	–	–	80	–	100	–	200	95	400	1200	400	600	850	500	–	–
Japan	300	900	700	1304	6311	8956	17371	14229	6318	47221	55442	40368	98168	41750	29151	57613	62343	72992	44473
Malaysia	–	–	–	–	–	–	–	–	–	–	–	–	54	–	–	–	–	–	–
N'lands	162	–	–	–	200	45	–	–	–	250	–	–	–	–	–	–	–	–	–
Ocean Is	–	–	–	–	–	20	–	–	–	–	–	–	–	–	–	–	–	–	–
S'pore	6920	5742	5915	1310	9521	13871	55018	48109	10038	16815	27920	52313	49372	56880	23606	36515	30344	35921	11565
Taiwan	–	–	–	–	–	–	–	100	–	360	210	1431	4448	1040	–	–	–	–	–
Total	9427	6642	6615	6842	22919	31332	78864	69654	20176	71373	85577	219585	175214	117943	59817	104323	95312	115643	96334

Table 96. Imports of tortoiseshell products from Indonesia reported in the Customs statistics of importing Countries (kg). All are raw shell except for Japan.

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Japan																				
Raw Bekko	223	938	160	183	0	0	0	0	0	59	286	1270	1448	921	980	536	1967	529	832	930
Raw Other shell	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	154	0	0	250	0

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
H. Kong	-	-	-	-	6483	4691	3808	9198	75335	14064	3000	0	4500	7995	9650	9000	-
Italy	-	-	-	-	0	150	363	0	-	-	-	-	-	-	-	-	-
Japan																	
Raw Bekko	736	3010	7197	20302	2693	4328	6464	10114	5659	19071	4811	1579	2032	3605	6604	5534	1740
Raw Other shell	0	0	0	80	0	0	0	0	76	92	100	0	0	0	0	-	-
Worked Bekko	3757	5665	19935	50204	43745	39706	41988	39283	30162	59457	41167	30803	18835	25871	20649	14121	7840
Worked Other	936	5949	21660	52546	54172	41159	47206	41668	25036	88584	58901	43092	42355	29341	43352	41138	8562
Korea	-	-	-	-	4300	4300	5500	3900	4103	10319	9000	6300	12270	14400	6500	9191	-
Malaysia	-	-	-	640	140	243	0	93	?	?	-	-	-	-	-	-	-
Taiwan	-	-	-	-	19	2650	12818	2780	30021	16998	340	3772	0	0	1768	0	-

Table 97. Percentage by weight of "Worked and art of Tortoiseshell" exported through different Indonesian ports of export (from Anon., 1984c).

Port	1978	1979	1980	1981	1982	Overall
(Medan)	12.0	3.4	4.0	–	–	5.1
Palembang	1.4	0.9	1.0	2.9	5.9	1.3
(Jakarta)	22.6	12.7	16.0	15.7	88.7	17.5
Jogjakarta	0	0	–	–	–	0
Surabaya	31.2	14.3	4.9	32.8	2.5	16.5
(Bali)	0.5	0.5	0.1	0.2	–	0.9
Balikpapan	–	0.1	–	–	–	0
Ujung Pandang	32.2	68.0	70.2	48.4	–	57.9
Pontianak	–	–	1.9	–	–	0.6
Teluk Air	–	–	0.5	–	–	0.2
Ambon	–	–	1.2	–	–	0.4

POPULATION: Chelonia mydas

Nesting sites Nests attributed to Green Turtles have been recorded on Hormuz island (Walczak, 1971) and on mainland beaches near Chah Bahar in Iranian Baluchistan, from Pasenvandan east to the border with Pakistan (Walczak and Kinunen, 1971). It is possible that some Green Turtles nest on Shitvar (Shotur, or Maru = Snake Island) and Lavan (Sheykh Sho'eyb) both in the Gulf, and Larak and Qeshm, both in the Straits of Hormuz, but at these sites the Hawksbill is certainly the predominant nesting species (Kinunen and Walczak, 1971).

Nesting numbers On present evidence, Green Turtle nesting numbers are relatively low. A total of 22 nests, comprising 18 found on 28 March (no more than two or three days old) and four new nests on the following day, were located on the island of Hormuz (Walczak, 1971). This was thought to be around the start of the nesting season. In Baluchistan, turtle tracks and around 12 recent nests were seen on a 3-km stretch of coast west of Paservandan, and 28 tracks, with around 11 nests, on a 20- to 25-km stretch of coast from Paservandan east to Gwater near the Pakistan border (Walczak and Kinunen, 1971). Ross and Barwani (1982) suggest an approximate annual total of 500 females.

Trends in nesting numbers No direct information, but exploitation and disturbance appear to be significant and local populations may be under some stress.

Nesting season Confirmed Green Turtle nesting has been recorded in late March in the Gulf (Hormuz), this was suggested to be at the start of the nesting season (Walczak, 1971), and in late October in Baluchistan (Walczak and Kinunen, 1971). It is possible that some level of nesting occurs throughout the year, and that there is a peak of activity at some period not covered by these reported surveys.

Foraging sites Green Turtles have been seen in small to moderate numbers foraging close inshore around the Gulf islands (Kinunen and Walczak, 1971; Bullock and Kinunen, 1971) and along the Baluchistan coast (Walczak and Kinunen, 1971). There are extensive feeding grounds around Chah Bahar in Baluchistan; these are composed of algae according to Walczak and Kinunen (1971), but of seagrasses according to Harrington (1976). Similarly, the excellent feeding grounds along the southern shore of Larak (Kinunen and Walczak, 1971) may contain seagrass rather than algae; 48 turtles were counted along a 7-km stretch of coast here.

POPULATION: Eretmochelys imbricata

Nesting sites Hawksbill nesting has been recorded on Shitvar (Shotur, or Maru = Snake Island) and Lavan (Sheykh Sho'eyb) in the Gulf, and on Qeshm, Larak and Hormuz in the Straits of Hormuz (Kinunen and Walczak, 1971).

Nesting numbers On Queshm, 27 tracks and/or nests were found 1-4 April, nearly half of these on an 11-km beach south of Khurbiz. Only six were found on Larak 5-6 April; there are relatively few suitable nesting beaches here (one of two fresh nests had been robbed of eggs by villagers). On Hormuz, 46 tracks and/or nests were found between 28 April and 1 May, on beaches extending for around 8 km in the east of the island, in an area known as Shat-e-lamba. These data would suggest a nightly mean of nearly eight nests for the three Straits islands as a whole, if all nests were

fresh; it seems likely that a significant proportion were old nests or even non-nesting tracks, and if nesting occurred at about half this rate, the seasonal total might be 50-100 females.

Around 500 nests were recorded 8-18 June on Lavan and Shitvar. The coastline of Lavan is about 50 km in extent, with about 7 km of good nesting beach. A total of 218 nests was recorded (including old and destroyed nests), 79 of these on a 2-km beach between the village of Gart and the LAPCO oil loading pier. Shitvar is a small and uninhabited island, 3 sq. km in area, 2 km from the eastern tip of Lavan. This island appears to be a major Hawksbill nest site; 250-300 nests were found, 95% of these on one 600 m beach on the island's eastern shore. By analogy with other known populations, Ross and Barwani (1982) suggest that the observed nest signs represent nesting by at least 300 females annually; they estimate up to 1000 may nest in Iran as a whole. The Lavan-Shitvar population, if persisting at this density, would be amongst the largest localised populations known, and the Shitvar beach one of the most important Hawksbill beaches in the world.

Trends in nesting numbers No direct information, but exploitation and disturbance appear to be significant and local population may be under some stress.

Nesting season Confirmed Hawksbill nesting has been recorded in April-May and in mid-June. The higher numbers recorded in the Gulf survey in June are as likely to reflect peak nesting at this time as preferred nesting sites.

Foraging sites Many of the Gulf and Straits islands support coral reef areas; Hawksbills have been seen off Hormuz and Queshm and, although there is little direct evidence, Hawksbills may forage throughout this region. Three dead Hawksbills were found on the beach near Beris, in Baluchistan (Walczak and Kinunen, 1971), suggesting that individuals may forage widely along the southern coast of Iran.

THREATS

There appears to be a low level of incidental catch and some nest predation by foxes, feral dogs, and possibly sand crabs Ocypoda (Kinunen and Walczak, 1971). Oil spillage may have affected turtles or nest beaches.

The current political situation is likely to have an adverse effect on turtle populations. News releases of November 1986 state that in response to Iraqi attacks, all Iranian oil-loading facilities had been moved from the Gulf to the Straits of Hormuz area; a 29 November 1986 news item stated that Iraqi jets had just bombed Larak, an island with extensive seagrass pastures known to support nesting and foraging turtles. Many further attacks in the area had subsequently taken place.

EXPLOITATION

Commodity Eggs are collected from nesting beaches on islands in the Gulf and the Straits of Hormuz, and presumably from mainland beaches also. They are not considered as a delicacy, but are collected mainly as a diet supplement. Turtles are also taken on occasion; although the meat is discarded, there is a small, and probably rather new, market for prepared carapaces (Kinunen and Walczak, 1971). In 1970, there was a small industry

on Lavak Island set up to extract oil from D. coriacea, about 10-15 of which were taken each year. Kinunen and Walczak (1971) found the remains of one C. mydas in the vicinity, but concluded that it must have been an incidental catch on the grounds that this species could not be used in the same way for oil extraction.

Hunting intensity Egg-collecting appears to be an irregular activity, entirely for subsistence purposes, on Hormuz, Larak and Lavan at least; it may be more regular on Shitvar. Although meat is said not to be eaten, turtles were occasionally killed for their shells, and the remains of 12 C. mydas were reported on the beach on Lavak Island, at least some of which were the result of human predation. Kinunen and Walczak (1971) considered that egg and turtle harvest was at that time minimal and likely to have little impact on turtle populations.

Domestic trade On Lavan, carapaces were sold to employees at the then (1970) recently established LAPCO oil loading pier; Green Turtles were preferred to Hawksbills, the shells fetching 250-500 rials each (U.S.$3-7 at 1971 rates of exchange) (Kinunen and Walczak, 1971).

International trade CITES Annual Reports contain no record of trade in sea turtle products with Iran.

LEGISLATION

There is no information on any protective legislation for sea turtles in Iran.

ISRAEL

POPULATION: Chelonia mydas

Nesting sites Isolated nests have been recorded at several localities north of Tel Aviv, including Netanya, Caesarea, Atlit, Nahariya and Rosh Haniqra. The last three sites were formerly the major, and almost the only, nesting beaches in Israel (Sella, 1982).

Nesting numbers Present nesting numbers are extremely small; there appear to be no sites supporting regular nesting or nesting by more than a handful of turtles. Only 10-20 nests, mainly of Caretta caretta and the remainder C. mydas, have been recorded each season in 1984-1986 (Z. Kuller in litt., 23 November 1986).

Trends in nesting numbers Sea turtles appear to be virtually extinct in Israel. Although most data refer to the Loggerhead (with 15 nests per km per season in the early 1950s, but only two nestings recorded along 250 km in 1979), the C. mydas nesting population appears to be even more vestigial (Sella, 1982; Kuller, 1986). Nesting formerly occurred on all sandy beaches in northern Israel, at least until the late 1930s (Sella, 1982).

Nesting season April-July (Sella, 1982).

Migration It has been speculated that turtles caught off the shores of Israel in the early part of the present century may have included a migratory component nesting on beaches in south-east Turkey (Sella, 1982).

POPULATION: Eretmochelys imbricata

There appear to be no confirmed records of the Hawksbill nesting in Israel, nor has the species been recorded anywhere in the eastern Mediterranean in recent decades.

THREATS

The most important of the nest beaches, at Nahariya, Rosh Haniqra and Atlit, were severely damaged between 1954 and 1963 by sand mining for concrete production. The beach area was substantially reduced, leading to flooding of nests and severe reduction in nest success. Sand excavation was subsequently stopped following recommendations of the Society for the Protection of Nature, and some improvement in beach quality was apparent after five years (but with no significant increase in turtle nesting).

EXPLOITATION

Commodities Both species of sea turtle (C. mydas and C. caretta) are eaten by both Muslims and Christians in Israel. Eggs may occasionally be collected and eaten (Sella, 1982).

Hunting methods During the 1930s, the fishery for sea turtles was a highly organised commercial operation, with specialised boats fishing only for turtles. Nets with a mesh size of 40 cm were used, and all turtles caught were kept (Sella, 1982).

Hunting intensity There is little systematic fishing of turtles in Israel still continuing. Trade in Acre has stopped completely since 1970, owing, according to Sella (1982), more to lack of profit than to the law against turtle fishing.

Historical trends Reliable sources indicate that at least 30 000 sea turtles (C. caretta and C. mydas) were taken by fishing crews organised by one operator (Abu Hanafi) between the end of World War I and the late 1930s (Sella, 1982). This fishery was at a maximum in the mid-1930s off Nahariya, Haifa and Atlit, all in the vicinity of Acre (northern Israel), with 24 boats ("12 crews of two boats each") working. At the height of the season 600 turtles would be taken per day, 90% being C. mydas, typically of 100-150 kg (Sella, 1982). The mean annual harvest over the 20-year period in question would be around 1500 turtles in all, including 1350 C. mydas. This would be a minimum take since other fishing crews were in operation at the same time. The turtle fishery continued into the 1960s but on a much reduced scale; it ceased altogether during World War II and subsequently was based on only occasional catches, not for export.

Domestic trade Since 1970, trade in turtles in Acre has stopped altogether. Fishermen were encouraged to sell their entire turtle catch to biologists for research purposes. Although some turtles were undoubtedly slaughtered elsewhere, a total of 53 C. mydas were purchased in the market in Acre in this way between 1963 and 1969 (Sella, 1982).

International trade Hornell (1934, cited in Sella, 1982) described the export of 2000 turtles a year from Palestine to Egypt; this implies that a significant proportion, and possibly the great majority, of C. mydas Turtles caught in Palestinean waters entered international trade. Given the political circumstances then prevailing in the region, it seems likely that a large proportion of these arrived ultimately in the English market. There are no records of trade in sea turtle products from Israel in CITES Annual Reports.

LEGISLATION

The hunting of sea turtles is prohibited by law in Israel (Sella, 1982). It is not certain under what legislation this is implemented, unless it is under the Wild Animals Protection Law, 1955, which prohibits the hunting of "protected" animals. An unofficial list of protected animals supplied by IUCN Environmental Law Centre included C. caretta, Chelonia, E. imbricata and D. coriacea.

IVORY COAST

No information available on population status.

EXPLOITATION

A turtle fishery operating out of Abidjan used to catch mainly C. caretta and L. olivacea, but it is possible that other species were taken. A total of 516 turtles were landed in 1967 and 797 in 1968. About the same number again of turtles was estimated to be thrown back because they could not be stored in the boats, and some (about 10%) were eaten on board by the crews (Goodwin, 1971).

International trade Ivory Coast is not a Party to CITES. There is no record of any trade in sea turtles with Ivory Coast recorded in the CITES Annual Reports.

LEGISLATION

Hunting and export of all wild animals has been forbidden since 1 January 1974. Licenees will be granted in exceptional cases.

Wildlife and Hunting Act, 4 August 1965.
    The possession and trade of Testudines, including sea turtles is prohibited and/or regulated.

POPULATION: Chelonia mydas

Nesting sites Kerr (1984) reported nesting at Malcolm Point, Sand Hill, Brighton Beach, Rocky Point, Spring Garden Beach, Hermitage and Orange Bay. However, neither Carr et al. (1982) nor Bacon (1981) reported any nesting on Jamaica and Haynes in litt. (18 November 1986) stated that nesting distribution was not known.

Nesting numbers Kerr (1984) estimated the number of nesting females to be 100. Haynes in litt. (18 November 1986) considered nesting turtles to be in low abundance and Carr et al. (1982) stated that no Green Turtles had been seen on shore in recent decades.

Trends in nesting numbers The nesting population appears to be decreasing (Haynes in litt., 18 November 1986).

Nesting season Kerr (1984) reported some nesting between March and October but, from the information given, it is impossible to separate Green Turtle nesting from that of other species.

Foraging sites Kerr (1984) noted numerous foraging sites around the island.

Migration Carr et al. (1982) reported the recovery at Morant Cay of a tag from a Green Turtle tagged while nesting at Tortuguera, Costa Rica.

POPULATION: Eretmochelys imbricata

Nesting sites Haynes in litt. (18 November 1986) reported nesting on available sandy beaches all round the island. Kerr (1987) reported nesting sites at Morant Cay, Plumb Point, Fort Charles, Guts River, Treasure Beach and Runaway Bay.

Nesting numbers Kerr (1984) estimated the number of nesting females to be 1400 but this was not based on field surveys and would appear to be an over-estimate; Bullis gave a lower figure of 300 nesting females. Carr et al. (1982) stated that only a few Hawksbills emerge each year. Bacon (pers. comm., 1988) confirmed that the nesting population was potentially quite large and that there were many small suitable beaches.

Trends in nesting numbers Haynes in litt. (18 November 1986) considered the nesting population to be decreasing. Kerr (1987) concluded from interviews with fishermen that there had been a serious decline.

Nesting season According to Carr et al. (1982), the nesting season is from April to August.

Foraging sites Kerr (1984) reported foraging around virtually all of the island. Frequent foraging by adults and juveniles was reported by Bacon (1981).

EXPLOITATION

Commodity The main commodities are meat, from the Green Turtle, and eggs and shell products from the Hawksbill (Haynes in litt., 18 November 1986).

Hunting intensity Official Statistics (cited in Kerr, 1984) show production in 1982 of 40 828 kg of turtle meat and 1859 kg of processed turtle shell. Kerr (1984) also provided other statistics on the intensity of exploitation. Using information from surveys and interviews, it was estimated that in 1982 catches (including incidental) totalled 472 (33 975 kg) Hawksbills and 27 (4980 kg) Green Turtles. Kerr further estimated that, in 1982, 20 000-30 000 eggs, more than 70 nesting females, and about 120 turtles at sea were taken for subsistence use.

Hunting methods Turtles and their eggs were generally taken whenever encountered, Hawksbills being captured with spearguns (Carr et al., 1982).

Historical trends Extensive early literature indicates that Jamaica was an important centre of sea turtle exploitation during the early days of colonisation of the Caribbean (Carr et al., 1982). Kerr (1984) estimated turtle catches of 143 372 kg and 28 710 kg in 1962 and 1967 respectively. Sea turtles were protected in Jamaica in 1982 and this caused an initial decline in the level of fishery. However, the enforcement has since been reduced and the number of people fishing for turtles is believed to have risen again, although there are no figures available to substantiate this (A.M. Haynes in litt., 15 January 1987).

Domestic trade Carr et al. (1982) noted local trade in eggs, meat and shell.

International trade Japanese imports of bekko and other shell from Jamaica are given in Table 98. Jamaica has clearly regularly served as a source of Hawksbill shell and exports have continued illegally since protection was granted in 1982.

Table 98. Imports to Japan of bekko and other tortoiseshell (kg) from Jamaica, 1950-1986, reported in Japanese Customs Statistics.

	1952	'53	'54	'55	'56	'57	'58	'59	'60	'61	'62	'63	'64	'65	'66	'67	'68
Bekko	550	415	801	375	657	1292	1617	0	2118	1618	1468	1490	1509	580	725	1572	809
Other	0	0	0	0	0	0	0	0	0	0	0	0	122	0	64	0	0

	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86
Bekko	776	600	943	1852	2521	222	286	343	683	128	559	695	419	1499	709	474	170	2182
Other	0	0	45	100	0	0	0	0	453	0	0	997	0	0	0	140	0	0

Jamaica is not a Party to CITES, but CITES Annual Reports from the period 1977-1985 record imports to F.R. Germany from Jamaica of Hawksbill shell totalling 551 kg in 1983, 153 kg in 1982, and 68 kg in 1981, all of which was declared as pre convention material. The Jamaican Ministry of Agriculture permitted the export of this material, having been satisfied that it was acquired before the turtles became protected, in 1982 (A.M. Haynes in litt., 15 January 1987). However, it is difficult to

understand how the German Management Authority could have interpreted this as "pre-Convention". Much of the shell was subsequently re-exported from F.R. Germany as "carvings", many of which are believed to be spectacle frames. It has been suggested (Milliken and Tokunaga, 1987a) that the increase in Japan's imports of bekko from Jamaica in 1986 was attributable to its newly adopted unofficial policy of obtaining supplies from countries not party to CITES.

LEGISLATION

Morant and Pedro Cays Law 1907.

Prohibited to catch turtles on the said Cays, or within three miles of them, without a licence from the Colonial Secretary.

Wildlife Protection Act, 20 September 1945

It is an offence to take, attempt to take, sell, or possess for the purpose of sale, any turtle egg.

Wildlife Protection (Amendment of Third Schedule) Regulations 1982 6 July 1982.

C. mydas, *E. imbricata*, *C. caretta*, *L. kempi*, *D. coriacea*.

The above species are added to the list of species protected under the Wildlife Protection Law. They may not be hunted and the possession of whole animals or parts thereof is prohibited.

POPULATION: Chelonia mydas

Nesting sites Whilst the species is recorded at sea around Honshu, and smaller islands to the south, nesting is restricted to the Nansei Shoto group (Ryukyu Archipelago) and the Ogasawara group (Bonin Islands). Within the Nansei Shoto, confirmed nesting records are from Yaku in the Osumi group in the north, and the Sakishima group in the south (Uchida, 1982 and 1985). In the Ogasawara Islands, nesting is known on Chichijima and Hahajima, and some adjacent islets, and may occur more widely (H. Tachikawa and H. Suganuma in litt., 19 December 1986).

Nesting numbers No information is available on the nesting population in the Nansei Shoto; however, there is no indication that large numbers are involved. Numbers appear to be relatively low in the Ogasawara group; Table 99 indicates the number of nests recorded on Chichijima (acknowledged not to be all nests laid). If similar numbers occur on Hahajima and a lesser number on other smaller islands, the annual nesting total in the group seems likely to be in the low hundreds. The Ogasawara group is the most important C. mydas nest site in Japan (Kurata, 1979).

Table 99. Number of nests recorded on Chichijima, Ogasawara Islands (data from H. Tachikawa and H. Suganuma in litt., 19 December 1986).

1978	1979	1980	1981	1982	1983	1984	1985	1986
39	123	82	122	108	150	269	222	190

Trends in nesting numbers The number of C. mydas in the Ogasawaras appears to have declined, although it is not clear to what extent actual nesting has decreased. According to Kurata (1979), about 1500 adults were caught annually in the area in the 1880s, but numbers have been much lower since the 1920s, until at present there are "at most only about 200 annual migrants" (Suganuma, 1985). Uchida (1985) regards turtles in the Nansei Shoto to be in danger of extinction, which implies some decline in numbers.

Nesting season Uchida (1985) reports that nesting season are indistinct at lower latitudes in Nansei Shoto. In the Ogasawara group, C. mydas arrive in February, nest between May and August (on many small beaches), and depart in September (Tachikawa and Suganuma, 1986).

Foraging sites No specific information (but see next paragraph).

Migration The C. mydas population is migratory, being found in the Ogasawaras, for example, only between February and September. Turtles tagged in the Ogasawaras have been recovered at various points mainly on the Pacific coast of the Japanese Archipelago, and this may constitute their main foraging grounds (Kurata, 1979). Seven females tagged while nesting have been recovered in the Ogasawaras at intervals of two to four years (Kurata, 1979).

POPULATION: Eretmochelys imbricata

Nesting sites As with C. mydas, the species occurs off the southern main islands of Japan, but nesting is restricted to the southern sector of Nansei

Shoto, from the Tokara group (Uchida, 1985) south to the Sakashima group (Uchida, 1982).

Nesting numbers No information is available, but numbers are unlikely to be large.

Trends in nesting numbers Uchida (1985) considers sea turtles in Nansei Shoto to be in danger of extinction; this implies a decline in Hawksbill numbers, but no detailed information is available.

Nesting season There appears to be no distinct nesting season in the southern Nansei Shoto (Uchida, 1985).

Foraging sites A few E. imbricata, mostly juveniles, occur in the Ogasawara group, but no nesting is known (Suganuma, 1985), and they are presumably foraging in the area.

EXPLOITATION

Commodity Sea turtles, particularly C. mydas and C. caretta are hunted for meat around the Ogasawara Islands and the southern parts of the main islands. Eggs are collected by villagers in Kagoshima Prefecture (Kurata, 1979; Uchida, 1982). Almost all of the E. imbricata shell in trade in Japan is thought to be imported.

Hunting intensity Uchida (1982) estimated that the total catch of C. mydas and C. caretta combined, in the Kagoshima, Wakayama and Kouchi Prefectures was about 50-100 adults a year. Most of the fishing for turtles in the Ogasawara Islands occurs off Chichijima, Hahajima and Mukojima. Catches in these three areas are summarised in Table 100. Some of the turtles are purchased from the fishermen and are held at the Ogasawara Marine Station to allow them to lay eggs before they are eventually returned to the fishermen for meat. Some turtles are tagged and released (see Table 100).

Table 100. Number of C. mydas caught commercially in the Ogasawara Islands. All were eventually used for meat except some which were tagged and released (data from H. Tachikawa and H. Suganuma in litt., 19 December 1986).

	Chichijima	Hahajima	Mukojima	Total	Released
1978	21	73	2	96	
1979	37	171	2	210	
1980	5	58	1	64	
1981	10	90	0	100	
1982	14	102	2	118	11
1983	14	72	0	86	16
1984	38	176	1	215	39
1985	6	109	3	118	10
1986	4	82	0	86	5

Hunting methods Most of the turtles are caught by harpoon or are turned on the nesting beaches. Nets are not used in Ogasawara (H. Tachikawa and H. Suganuma in litt., 19 December 1986).

Historical trends The longest records of turtle catches are from the Ogasawara Islands. Americans and Europeans settled on the islands in 1830 primarily to catch turtles. The Islands were ceded to the Japanese in 1876, and catch records were kept from 1880 onwards. Kurata (1979) plotted the annual catches of C. mydas from 1880 to 1979. There was a gradual decline from 1850 turtles in 1880 to about 100 in 1923. From then to 1975, the catch fluctuated below about 200 (mostly below 100). A slight increase appeared to take place from 1976 onwards (see Table 100). Uchida (1982) reported that the turtle fishery in the Kagoshima, Wakayama and Kouchi Prefectures seemed to have begun only after World War II.

Domestic trade Milliken and Tokunaga (1987a) have described the domestic trade in turtle products in Japan in considerable detail. The main use is the carving of the shell of E. imbricata into jewellery and other ornaments. Stuffed turtles, both E. imbricata and C. mydas, have become popular since the 1970s, and are considered to be a symbol of good luck and longevity.

International trade Japan is the world's largest importer of E. imbricata shell. Imports of turtle products are recorded in Customs statistics under various categories which are set out in Table 101. Imports of these commodities are given in Tables 102-106. Milliken and Tokunaga (1987a) analysed the various products included in each of these categories and concluded that "bekko" (Table 102) represented almost exclusively the unworked shell of E. imbricata, the shell from one animal averaging 1.06 kg in weight. The "other tortoiseshell" (Table 103) represented chiefly the unworked shell of C. mydas, and was of very minor importance. "Worked bekko" (Table 104) comprised almost entirely whole, stuffed E. imbricata, each animal having an average weight of around 1.15 kg. "Worked tortoiseshell, not elsewhere specified" (Table 105) was mostly whole, stuffed C. mydas interspersed with a few C. caretta, having an average weight of 2.4-2.6 kg per specimen. "Turtle skins" (Table 106) were untanned, usually wet-salted skins of L. olivacea and C. mydas, while "Turtle leather" (Table 107) were tanned skins of the same two species.

RANCHING/HATCHERIES

Turtle hatcheries were operated in the Ogasawara Islands from 1910 until 1939 in response to fears of falling turtle populations. Over this period, some 40 000 turtles were released. The hatchery closed down during the war but resumed in 1972 (Kurata, 1979). From 1975 to 1981 it released 61 528 hatchlings, and from 1982 to 1984 a further 36 601, with an overall hatching success rate of 73% (Suganuma, 1985).

LEGISLATION

Tachikawa and Suganuma (in litt., 19 December 1986) summarised the legislation passed by the Tokyo Metropolitan Government protecting sea turtles in Japan:

All turtle fishing is prohibited in June and July.
Collection of eggs is prohibited.
Capture of turtles of less than 75 cm C.C.L. is prohibited.

Table 101. Tariff headings for turtle products used in Japanese Customs reports.
The table in which each of these categories is included is given at the bottom of each column.

1950	Unworked tortoiseshell		Fancy articles of tortoiseshell			
1962	Bekko 291.141	T'shell, claws & waste of T'shell other than bekko 291.149	Worked bekko & articles thereof n.e.s. 899.111	Worked T'shell & articles thereof n.e.s. 899.112		
1976	Bekko 05.11-100	T'shell, claws & waste of T'shell other than bekko 05.11-200	Worked bekko & articles thereof n.e.s. 95.10-100	Worked T'shell & articles thereof n.e.s. 95.10-200	Turtle skins 41.01.274	Turtle leather 41.05.310
1979	Bekko including waste 05.09-060	Other T'shell & claws, including waste 05.09-070	Worked bekko & articles thereof n.e.s. 95.05-211	Worked T'shell & articles thereof n.e.s. 95.05-231		Turtle leather 41.05.231
1985		(Included with other animal products)				
1986						
	Table 102	Table 103	Table 104	Table 105	Table 106	Table 107

Table 102. Sources of imports of "bekko" (see Table 101) reported in Japanese Customs reports (kg).

Source	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
Antigua/Barbuda	0			-	-	-	-	-	-	-	-
Australia	-	12193			-	-	-	-	-	-	-
Bahamas				-	23	-	-	8	2746	2453	1563
Barbados	-			-	-	-	5	12	-	-	-
Belgium	0				-	-	-	-	-	-	-
Belize	-		-	-		-	17	-	147	495	204
Brazil	-			-	-	15	-		-	-	-
Canada	-		-		-	-	-	-	-	-	-
Cape Verde	0		-	-	-	-	-	-	-	-	-
Caymans				-	-	-	-	-	59	2109	454
China	-		120	-	-	-	60	-	-	-	-
Colombia	-				-	-	-	-	-	-	-
Comoro Is	0				-	-	-	-	-	-	-
Costa Rica	-	133	453	251	274	490	349	159	-	-	-
Cuba	-		299	231		-	-	-	749	1034	3131
Dominica					-	-	-	-	-	-	-
Dominican Rep.	0		-		-	-	-	-	-	-	-
Ethiopia	-		-	-	-	-	-	-	-	-	-
F.R. Germany	-	12279		-	-	-	-	-	17	91	-
Fiji	-			-	-	-	23	-	-	-	-
France	-		-	-	-	-	-	-	-	-	-
French West Indies			-	-	-	-		-	-	-	-
Grenada	0				-	-	-	-	-	-	-
Guam			21	43	-	-	-	-	-	-	-
Guyana	-		-	-	-	-	-	-	-	-	-
Haiti	-				-	-	-	-	-	311	-
Honduras	-	-	-	-	-	-	16	111	165	-	155
Hong Kong	-		-	2032	-	-	-	-	1310	-	-
India	-		5	22	74	-	-	147	-	-	-
Indonesia	223	938	160	183		-	-	-	-	59	286
Italy			-	-	-	93	-	-	-	-	-
Jamaica	-		550	415	801	375	657	1292	1617	-	2118
Japan(Okinawa&Ryukyu)	-		115	2	105	945	23	-	59	-	113
Kenya			-	77	-	11	-	-	-	-	-
Madagascar	-				-	-	-	-	-	-	56
Malaysia (Sabah)	1472	-	-		-	-	-	-	327	-	362
Malaysia (Sarawak)	-			-	-	-	-	-	-	-	-
Malaysia (West)	-	7657	585	29	208	265	819	697	12	-	-
Maldives	0				-	-	-	-	-	-	-
Mexico	0			-	-	-	-	-	-	-	-
Mozambique	0			-	-	-	-	-	-	-	-
Netherlands	286	535	2318	2320	1186	1711	1239	3021	2320	2265	2983
Netherlands Antilles	-		-		-	-	-	-	-	-	-
Nicaragua	-			-	-	-	65	-	-	-	-
PNG (Bismark)	-		-		-	-	-	-	-	-	-
Panama			1166	712	-	-	-	-	-	3210	8376
Panama (Canal Zone)	-	-	-	-	-	-	-	-	-	-	-
Philippines	-	500	152	-	100	979	419	497	300	-	208
Portugal	0		-	-	-	-	-	-	-	-	-
Puerto Rico	-		-	-	-	-	-	-	-	-	-
Reunion	0	-	-	-	-	-	-	-	-	-	-
Romania	-	-	-	-	-	-	-	-	-	-	-
Saint Lucia	0	-	-	-	-	-	-	-	-	-	-
Saint Vincent	0	-	-	-	-	-	-	-	-	-	-
Saudi Arabia	0		-	-	-	-	-	-	-	-	-
Seychelles	-		-	-	-	-	-	-	-	-	-
Singapore	317	706	164	373	940	626	139	230	1437	1625	2014
Solomon Is	-	-	-	-	-	-	-	-	-	-	-
Somalia	0	-	-	-	-	-	-	-	-	-	-
Spain	0		-	-	-	-	-	-	-	-	-
Sri Lanka	0		-	-	-	-	-	-	-	-	-
Taiwan	0	-	-	-	-	-	-	-	-	-	-
Tanzania	-		110	-	127	156	-	73	825	169	-
Tanzania (Zanzibar)	-	-	568	279	-	276	66	1346	-	348	-
Thailand	-		-	-	-	-	-	-	-	-	-
Trinidad and Tobago	-	-	102	-	32	137	131	95	423	-	-
Turks,Caics&Caymans	-	-	-	-	-	-	-	-	-	-	-
UK	-	-	653	2610	914	1090	2268	2565	1347	4	-
USA	-	142241	150	-	68402	-	-	-	-	91	91
Vanuatu	0	-	-	-	-	-	-	-	-	-	-
Venezuela	-	-	-	-	-	-	-	453	68	2447	-
Windward Islands	-	-	-	-	-	-	-	-	-	-	95
Windw'd & Leew'd Is	-	-	-	-	-	-	-	-	-	-	-
Yemen PDR	-	-	-	-	-	-	-	-	-	-	-
Zambia	-	-	-	-	-	-	-	-	-	-	-
Total	2298	177182	7691	9579	73186	7169	6236	10766	13928	16711	23643

Source	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Antigua/Barbuda	-	-	-	-	-	-	-	-	-	-	-
Australia	-	137	218	563	513	1128	1969	1673	1657	1654	894
Bahamas	911	456	345	368	204	739	680	360	239	127	109
Barbados	-	-	-	64	292	-	-			398	338
Belgium	-	-	-	-	-	-	-		-	-	-
Belize	241	219	112	-	-	222	209	243		97	82
Brazil	-	-	-	-	-	-	-	-	-		-
Canada	-	-	-	-	75	-	-				-
Cape Verde	-	-	-	-	-	-	-	-	-	-	-
Caymans	-	-	-	-	-	-	-	-	-	-	-
China	-	-	-	-	-	-	-	39		-	-
Colombia	-	-	-	-	-	212	401	167	82	0	26
Comoro Is	-	-	-	-	-	-	-	-			
Costa Rica	-	582	473	1039	431	793	-	381	418	360	189
Cuba	3292	2825	1533	1303	2054	3013	2146	6819	7632	5435	5946
Dominica	-	604	1343	1767	1549	1820	1352	1178			-
Dominican Rep.	-	-	-	-	-	-	-				
Ethiopia	-	-	-	-	-	-	-	420		573	453
F.R. Germany	-	-	-	-	-	-	-	-	-		
Fiji	-	17	198	516	341	118	382	136	306		
France	-	-	-	-	-	-	-	-	37		
French West Indies	-	-	-	183	-	-	-	-	145	266	-
Grenada	-	-	-	-	-	-	-	-			-
Guam	-	-	-	-	-	-	-	-			-
Guyana	-	-	-	-	-	27	-				
Haiti	827	2090	899	899	635	820	1016	1468	1482	1415	1415
Honduras	-	-	71	-	162	-	-	-	121		-
Hong Kong	1658	977	-	-	-	-	-		-	0	39
India	161	-	1383	618	-	20	89			591	769
Indonesia	1270	1448	921	980	536	1967	529	832	930	736	3010
Italy	-	-	-	-	-	9	-	-	-		-
Jamaica	1618	1468	1490	1509	580	725	1572	809	776	600	943
Japan(Okinawa&Ryukyu)	15	17	-	-	33	-	-		201	-	
Kenya	18	81	-	-	-	-	44		34	0	38
Madagascar	-	-	-	-	-	-	-	-	-	64	-
Malaysia (Sabah)	-	307	366	179	-	851	548	400	383	720	96
Malaysia (Sarawak)	-	-	-	-	68	41	47	45		0	1010
Malaysia (West)	12	946	1211	508	467	492	41	194	932	343	0
Maldives	-	-	-	-	-	-	-	-	-	-	-
Mexico	-	-	-	-	-	-	-	-	-	-	-
Mozambique	-	-	-	-	-	-	-	-	-	-	-
Netherlands	2714	1784	1784	1391	1485	821	-	1414	1626	528	1370
Netherlands Antilles	-	-	-	-	-	-	-	-	68	-	-
Nicaragua	-	-	-	54	-	-	234	227	685	789	1060
PNG (Bismark)	-	-	-	-	-	153	163	-	344		
Panama	7352	8897	9998	12098	9357	11998	9866	8259	12189	10744	11981
Panama (Canal Zone)	-	-	-	-	-	192	-	1144	281	-	-
Philippines	-	537	149	-	-	-	187	445	1050	976	583
Portugal	-	-	-	-	-	-	-	-	-	-	-
Puerto Rico	-	-	1612	226	227	-	196	77	585	974	700
Reunion	-	-	-	-	-	-	-	-	-	-	-
Romania	-	-	-	213	-	-	-	-	-	-	-
Saint Lucia	-	-	-	-	-	-	-	-	-	-	-
Saint Vincent	-	-	-	-	-	-	-	-	-	-	-
Saudi Arabia	-	-	-	-	-	-	-	-	-	-	-
Seychelles	-	-	-	-	-	-	-	-	22	449	275
Singapore	3630	4713	3134	2086	3283	3101	4308	5961	5703	4844	1274
Solomon Is	-	-	-	-	-	63	901	1233	1213	1469	816
Somalia	-	-	-	-	-	-	-	-	-	-	-
Spain	-	-	-	-	-	-	-	-	-	-	-
Sri Lanka	-	-	-	-	-	-	-	-	-	-	-
Taiwan	-	-	-	-	-	-	-	-	-	-	-
Tanzania	990	2220	884	593	794	-	-	-	-	-	-
Tanzania (Zanzibar)	3118	1272	2103	2564	1554	-	-	-	-	-	-
Thailand	-	-	-	-	-	-	-	-	-	-	-
Trinidad and Tobago	231	755	530	-	-	-	-	-	-	-	-
Turks,Caics&Caymans	-	-	181	195	306	621	550	151	334	149	85
UK	351	286	10	-	57	-	65	-	-	-	-
USA	42	-	-	-	-	109	41	-	-	0	153
Vanuatu	-	-	-	-	-	-	-	-	-	-	-
Venezuela	-	-	-	-	-	-	-	-	-	-	-
Windward Islands	468	231	-	-	-	-	-	-	-	-	-
Windw'd & Leew'd Is	-	-	-	159	1119	91	-	90	238	-	-
Yemen PDR	-	36	-	-	-	-	-	-	-	-	-
Zambia	-	-	-	-	200	-	-	-	-	-	-
Total	28919	32824	30948	29815	26376	32327	31945	37724	40975	36961	35575

Table 102, continued. Sources of imports of "bekko" (see Table 101) reported in Japanese Customs reports (kg)

Source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Antigua/Barbuda								-	-	-	-	49	286	221	293
Australia		397	364	977	1087	192				-	-	-			
Bahamas	1474	580	218	449	532	927	1018	1886	767	29	728				
Barbados	337	344	310	31	13		23		9	-	11				116
Belgium										203	-				
Belize		28	279		12	40		314	258	-	702	538		1195	2231
Brazil															
Canada										-	40	-			
Cape Verde					63			67	117	81	45	85			
Caymans	78	936	963	1083	3096	3863	6321	6110	2505	3022	2258	-	115		
China															
Colombia		37	58	45						-	-				
Comoro Is									45	-		-			225
Costa Rica	387	265	175	515	170	260	47	89		234	79	5			
Cuba	5100	8100	6245	6100	6975	3984	6600	3725	7338	2050	6933	5017	4200	7816	5688
Dominica		6			126			114	90	60	39	40		174	219
Dominican Rep.	62	4	11	31	113	507		219	534	357	872	248	636	203	569
Ethiopia	286	500	400	500											427
F.R.Germany										-	-		226		
Fiji	169	607	131	91	189	82	399	539	328	162	280	309	242	294	497
France								18			-				
French West Indies				122	152	198	276	123	196	231	215	-			
Grenada		499		132		59			9	7					
Guam										-					
Guyana											-	-			
Haiti	1303	2390	678	831	1094	1173	959	1689	1020	892	1188	1788	1988	2203	2767
Honduras		316		38	-	71	9	9	1132	481	636	1886	2463	2217	
Hong Kong	968	2124	15	243	-	163	89	945		104	-	-	-		
India	244	1193	74	150	194	68	20				-	-			
Indonesia	7197	20302	2693	4328	6464	10114	5659	19071	4811	1579	2032	3605	6604	5534	1740
Italy															
Jamaica	1852	2521	222	286	343	683	128	559	695	419	1499	709	474	170	2182
Japan (Ryukyu Is)						-				-	-	-			
Kenya	183	1744	84	1169	2654	2655	2850	2051	463	1404	572	938	2111	3110	400
Madagascar	250	570	100	100	60					-					138
Malaysia (Sabah)	-	56							-					-	
Malaysia (Sarawak)	108									-	-	-	74	-	
Malaysia (West)	-				-	45	-			-	196	349	-		
Maldives	-	65	89	340	485	317	567	1266	167	355	601	406	822	2225	1956
Mexico		8						-	-	-	-	36	-		
Mozambique	-	452			277						-	-	-		
Netherlands	933	2014		193	536	1017	1288	3549	1305	448	-	1077	-	-	
Netherlands Antilles	-			-		-	-			-		-		-	-
Nicaragua	1316	994	2646	1632	1446	1573	1014	949	7	475	417	-		192	
PNG	-	181						-			-	-	-		
Panama	8389	8990	9350	9313	5885	4450	6505	4810	3360	3011	2243	3889	4259	1500	-
Panama (Canal Zone)	-					-		-	-		-	-	-	-	-
Philippines	3285	4467	4621	1288	2369	3313	1416	3539	2514	1439	1376	232	1227	276	
Portugal	-	-	-	-	55	88				-	-	-		-	459
Puerto Rico	498	341	45	165	262	264	-	18	-	-	-	-	-	-	-
Reunion	-		-	-	377	-	-			-	-	-	-	-	-
Romania	-					-	-				-	-		-	-
Saint Lucia	-	345	288	332	-	489	349	152	143	267	270	362	-		-
Saint Vincent	-	243	250	191	130	230	144	-		-	36	108	242	191	470
Saudi Arabia	-			-	-	-	-	110		-	-	-	-	-	-
Seychelles	-		136	177	106	523	976	1027	618	423	472	675	629	61	
Singapore	3942	7578	967	2320	2850	4080	1799	2417	364	522	724	1471	1865	2808	4586
Solomon Is	1590	378	657	846	-	756	528	924	704	336	1206	992	1127	1556	1793
Somalia	75	395	320	100	873		-	-	-	-	-	-	-	246	645
Spain	-		-	-	-	-	-	-	-	-	-	-	-	178	
Sri Lanka	-	-		-	-	-	-	-	46	-	-	17	-	-	-
Taiwan	-	469		130	25		150	-	1323		-	-	50	23	-
Tanzania	1729	2356	1688	1719	2152	1474	1410	5943	1202	845	836	168	540	1032	133
Tanzania (Zanzibar)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Thailand	-		-	-	-	-	-	-	-	-	-	-	-	-	-
Trinidad & Tobago	-		-	-	-	-	-	-	-	-	-	329	544	208	-
Turks Caics&Caymans	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UK	10	234	149	86	209	-		-	-	-	-	-	-	-	-
USA	-	6	-	-	-	-	-	-	-	-	-	22	-	-	-
Vanuatu	-	-	-	-	-	-	-	-	33	-	-	-	-	-	-
Venezuela	-	171	-	-	-	-	-	-	-	-	-	-	-	-	9
Windward Islands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Windw'd & Leew'd Is	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yemen PDR	-		-	-	-	-	-	-	-	-	-	-	-	-	-
Zambia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	41765	73206	34223	36053	41374	43653	40544	63555	30830	20036	26506	25400	30697	33610	27543

Table 103. Sources of imports of "tortoiseshell claws and waste other than bekko" (see Table 101) reported in Japanese Customs reports (kg).

Source	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Amer. Samoa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	42	–	–	–	–	–	–
Australia	–	49	–	–	–	–	–	–	–	–	–	–	–	–	6	–	–	–	–	–	–
Bahamas	57	16	–	14	55	–	9	40	–	–	–	–	–	–	–	–	–	–	–	–	–
Caymans	–	–	–	–	–	–	–	–	–	409	68	–	906	–	1179	1577	535	434	1904	84	53
China	–	–	–	–	–	–	915	750	2950	2150	1410	405	1851	1331	240	569	405	600	1210	250	168
Cuba	–	–	–	–	–	–	–	–	–	200	–	–	10	–	–	750	225	–	950	–	460
Dominican Rep.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	62	–	–	44	–	–	–
F.W. Indies	–	–	–	–	–	–	–	–	–	–	–	–	–	38	–	–	–	–	–	–	–
Fiji	–	–	–	–	–	–	–	–	101	–	–	–	–	–	–	–	–	–	–	–	–
Haiti	45	52	–	–	–	8	82	568	651	–	–	–	–	–	45	–	–	–	–	–	–
Hong Kong	–	–	–	–	–	–	–	–	–	–	–	16	46	–	–	1031	–	–	–	–	–
India	10	–	–	–	–	–	–	–	100	208	–	–	–	21	–	–	–	–	–	–	–
Indian Ocean	–	–	–	–	–	–	–	–	–	–	–	–	–	68	–	–	–	–	–	–	–
Indonesia	–	154	–	–	250	–	–	–	–	80	–	–	–	–	76	92	100	–	–	–	–
Jamaica	122	–	64	–	–	–	–	45	100	–	–	–	–	453	–	–	997	–	–	–	140
Kenya	–	–	–	–	–	–	12	–	–	–	–	–	58	–	–	–	–	–	715	–	429
LW WW Isles	45	–	–	–	–	–	–	–	18	–	–	–	–	–	–	–	–	–	–	–	–
Malaya	10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Maldives	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	414	–	–	–	102	230
Nicaragua	–	–	–	–	–	–	–	–	–	–	66	–	–	–	–	–	–	–	–	–	–
Nigeria	–	–	–	–	–	–	87	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pakistan	–	–	–	–	–	–	–	–	–	–	–	–	745	–	–	136	330	–	–	133	–
Panama	–	5	–	–	–	–	–	–	354	453	–	512	–	–	–	–	452	362	–	–	–
Philippines	–	–	–	–	–	1279	32	–	2793	8979	12301	200	791	–	23	157	1214	20	–	–	–
Puerto Rico	–	–	–	–	–	27	–	32	–	–	–	–	–	–	25	–	–	–	–	–	–
Reunion	–	–	–	–	–	–	–	–	–	–	–	–	–	–	46	–	–	–	–	–	–
Ryukyu (Jap.)	–	–	–	–	–	247	–	930	–	–	–	–	–	–	–	–	–	–	–	–	–
Sabah	–	–	–	–	–	–	1481	105	–	–	–	–	–	–	–	–	–	–	–	–	–
St Lucia	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	339	95	–	–	–	–
Sarawak	–	–	–	–	–	–	–	1455–	–	–	–	–	–	–	–	–	–	–	–	–	–
Seychelles	–	–	–	–	–	–	–	–	–	–	–	–	–	54	90	62	126	–	–	–	
Singapore	14	–	–	–	–	–	–	–	2874	5749	–	75	279	–	45	34	–	100	–	–	–
Somalia	–	–	–	–	–	467	–	–	600	–	–	–	–	–	–	–	–	–	–	–	–
Sri Lanka	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	150	–	–	–	–	–
Taiwan	200	450	300	–	280	–	500	200	34	40	–	–	–	–	–	–	2300	–	–	–	–
Tanzania	23	45	–	–	–	23	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Thailand	–	–	–	–	–	–	700	200	500	–	–	–	–	200	1550	1980	1200	–	–	–	–
UK	67	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
USA	40	36	–	–	–	–	–	–	–	27	120	–	–	–	66	–	–	–	–	–	–
Zanzibar	–	113	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	633	920	364	14	585	2051	3818	4325	11075	18295	13965	1208	4686	2165	3495	7291	7979	1560	4779	569	1480

Table 104. Sources of imports of "worked bekko" (see Table 101) reported in Japanese Customs statistics (kg).

Source	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Brazil	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-	-	-
Caymans	-	-	-	202	-	-	-	-	-	-	-	-	-	-	-	-	-
China	81	280	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-
Dominica	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
Dominican Rep.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	-
France	-	1	1	-	1	-	1	-	-	-	-	-	-	-	-	-	-
Hong Kong	145	-	153	1917	138	276	370	-	27	39	3	-	-	6	-	-	1007
India	-	-	-	-	-	-	22	-	-	-	-	-	-	-	-	-	-
Indonesia	3757	5665	19935	50204	43745	39706	41988	39283	30162	59457	41167	30803	18835	25871	20649	14121	7840
Italy	-	-	16	-	6	-	-	-	-	7	-	-	-	-	-	-	-
Korea, S.	-	-	-	31	-	-	-	-	-	-	-	-	-	-	-	-	-
Malaya	-	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-
Maldives	-	-	-	-	-	-	-	-	-	226	270	-	-	-	-	-	-
Philippines	-	-	-	987	1965	1657	1373	740	727	1618	936	-	-	-	-	-	-
Ryukyu (Japan)	4384	7961	3109	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sabah	-	-	-	326	-	-	-	-	-	-	-	-	-	-	-	-	-
Seychelles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-
Singapore	962	1356	9589	23151	16624	6384	6790	2795	10225	11786	10455	540	178	985	-	-	-
Spain	-	-	-	-	-	-	-	42	-	-	-	-	-	-	-	-	-
Sri Lanka	-	-	5	180	-	-	-	-	-	-	-	-	-	-	-	-	-
Taiwan	-	-	5981	8280	10923	5921	1570	1024	597	2434	794				1	-	-
UK	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
USA	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
Viet Nam	-	36	1	521	668	24	93	4	-	-	-	-	-	-	11	8	8
Total	9329	15299	38790	85834	74070	53968	52207	43889	41740	75567	53641	31343	19013	26865	20689	14137	8855

Table 105. Sources of imports of "worked tortoiseshell" (see Table 101) reported in Japanese Customs statistics (kg).

Source	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Ryukyu(Japan)	23261	26170	8824	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Taiwan	96	1165	6231	29986	23134	7457	2004	463	687	1556	135	7511	0	0	0	0	0
Singapore	191	1559	16146	21064	11045	7970	10270	8947	24671	27381	8183	0	240	1336	0	0	0
Indonesia	936	5949	21660	52546	54172	41159	47206	41668	25036	88584	58901	43092	42355	29341	43352	41138	8562
Hong Kong	0	0	473	475	0	0	0	0	0	1	2	0	0	0	0	0	2850
Malaysia	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Philippines	0	0	157	1063	7226	6812	1599	6693	5454	9276	7919	7511	1989	4072	0	0	0
Switzerland	0	0	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Viet Nam	0	0	0	23	0	0	0	0	0	0	0	0	0	0	0	0	0
Thailand	0	0	0	0	238	0	0	0	0	0	0	0	0	0	0	0	0
USA	0	0	0	72	0	0	0	0	0	0	0	0	0	0	0	0	0
Mexico	0	0	0	310	33	0	0	0	0	0	0	0	0	0	0	0	0
Cayman Is	0	0	0	184	0	0	0	14	0	0	0	0	0	0	0	0	0
India	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0
Sri Lanka	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Italy	0	0	0	0	0	0	0	0	15	0	0	1	0	0	0	0	0
France	0	0	0	0	0	0	0	0	0	0	0	0	360	0	0	0	0
Morocco	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0
Total	24484	34843	53529	105723	95848	63418	61079	57785	55865	127002	75140	50604	44944	34749	43362	41138	11412

Table 106. Sources of imports of "turtle skin" (see Table 101) reported in Japanese Customs statistics (kg).

Source	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Belgium	3283	-	-	-	-	-	-	-	-	-	-
Cayman Is.	-	36	23514	2824	14778	6687	-	-	-	-	-
Ecuador	40275	62073	40807	79839	16313	8465	3376	3000	8943	-	33765
France	-	-	-	480	-	-	-	-	-	-	-
Indonesia	-	145	6261	3018	4160	7585	20587	14759	13737	10369	2025
Mexico	35231	5244	1061	9075	-	-	-	-	-	-	-
Nicaragua	883	2322	640	-	-	-	-	-	-	-	-
Pakistan	4648	1016	5360	3248	2100	2400	-	-	-	2925	-
Panama	-	-	2546	-	-	-	-	-	5518	12836	-
Philippines	18610	6408	3857	-	7531	-	625	2988	-	-	-
Singapore	-	-	9673	10981	8660	-	2667	-	-	-	-
Taiwan	-	-	726	-	-	-	-	-	-	-	-
Thailand	-	-	-	-	-	-	80	-	-	-	-
USA	1676	-	-	-	-	-	-	-	-	-	-
Total	104606	77244	94445	109465	53542	25137	28535	20747	28198	26130	35790

Table 107. Sources of imports of "turtle leather" (see Table 101) reported in Japanese Customs statistics (kg).

Source	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Belgium				875	–	–	–	–	–	–	–
Belize	–	–	–	–	168	–	–	–	–	–	–
F.R. Germany	120	–	–	–	–	–	–	–	–	–	–
Indonesia	–	–	–	–	–	–	144	–	127	–	–
Italy	–	–	3	–	–	–	–	–	–	–	–
Mexico	11065	6835	11646	12445	11506	10536	8007	5180	2638	1125	3772
Netherlands	–	28	–	–	–	–	–	–	–	–	–
Singapore	186	145	154	107	373	250	25	26	95	55	–
Taiwan	–	–	–	–	–	19	–	–	–	–	–
Total	11371	7008	11803	13427	12047	10805	8175	5206	2860	1180	3772

According to Bourret (1941), both C. mydas and E. imbricata occurred all around the coast of the former French colonies in Indochina, which would include the present Kampuchea, and both species, at the time of his writing, were considered to be common. Nesting appears to have been mainly limited to the offshore islands, notably those off the west coast of Cochin China, but very little detailed information is available. References by Bourret (1941) to the west coast of Cochin China seem likely to refer in part to islands and waters now within Kampuchean territory, but largely to islands, including Quan Phu Quoc, in Vietnamese territory. The Poulo Wai group is the only nest site specifically named in available literature (Bourret, 1941); this seems likely to be the same as the Ko Way group, situated in the north-east Gulf of Thailand some 60 km from the coast of Kampuchea. Both C. mydas and E. imbricata appear to have nested in the group, and eggs for the Hawksbill rearing operation near Ha Tien (Viet Nam) were taken from this site (Le Poulain, 1941). The Hawksbill was said to be most abundant off the west coast of the Cochin China region. Hawksbill nesting in the islands off the west coast of Cochin China takes place in December-February (Le Poulain, 1941).

No information is available on recent population levels.

EXPLOITATION

Commodity C. mydas was said to be actively sought for its meat in Indochina, while E. imbricata was not eaten and was considered poisonous. The eggs of both species were popular and were traded locally. There was a well established Hawksbill shell industry (Bourret, 1941).

Hunting intensity No information is available on recent exploitation.

Hunting methods Turtles were usually caught with nets about 200 m long and 3 m deep, having a mesh size of 40 cm. These were used to encircle shallow areas, from which the turtles would be frightened into the nets by fishermen beating the water with sticks. In deeper waters, trawling was used, and turtles were also turned on the nesting beaches (Le Poulain, 1941).

Historical trends The villages of Samit and Luc-son, in Kampuchea, were said to be centres for turtle fishing (Le Poulain, 1941). Bourret (1941) reported that hawksbill shell was used locally to make combs and opium pipes. However this may have been an imported skill, as Bourret reported that Pavie, during his visit in 1876, taught fisherman at Kampot how to prepare Hawksbill carapaces, and that this activity later developed into a local industry.

Domestic trade In 1941, Hawksbills were said to be worth about 12 Piastres each for their shell, while Green Turtles only sold for 8 Piastres (Le Poulain, 1941).

International trade Bourret (1941) stated that shell from the Cochin China region, which, as noted above, appears likely to include islands presently within Kampuchea, was sent to supply the tortoiseshell industry in the Tonkin region of Viet Nam (Bourret cites brushes and boxes as among the products of this industry).

Kampuchea is not a Party to CITES, and no trade in sea turtle products has been recorded in the CITES Annual Reports. The only reference to trade in tortoiseshell with Kampuchea in the Customs reports consulted was the import

of 8260 kg to Hong Kong in 1974, but this may have represented the shell of freshwater turtles.

LEGISLATION

No information.

RANCHING

Hawksbill turtle ranches similar to the ones in Viet Nam (q.v.) were said to have operated in the region of Kep, but they had disappeared several years previous to 1941 (Le Poulain, 1941).

POPULATION: <u>Chelonia mydas</u>

Nesting sites Most nesting occurs on sand beaches along the mainland coast between Malindi and Lamu (south of the former, limestone cliffs are prevalent, and north of the latter, mangrove forests), and also on islands (including some north of Lamu) (Frazier, 1974). Most C. mydas nesting appears to take place on the more remote mainland coasts at Ras Biongwe and Ungwana Bay, on the adjacent islands of Lamu and Manda, and on the small island of Tenewi (Frazier, 1982). These sites are restricted to the northern third of the coast, over a stretch of some 150 km.

Nesting numbers No site-specific information is available, but the total number nesting annually appears to be low, between 100 (Frazier, 1975b) and 200 (Frazier, 1982).

Trends in nesting numbers Both nesting and feeding populations were said to be reduced in number (Frazier, 1974), or to be "decimated" (Ray, 1969). No precise information on supposed trends appears to be available. The presumed decline is attributed to persistent exploitation, pollution, coastal development and nest predation (Frazier, 1982).

Nesting season According to Frazier (1975b) nesting is generally concentrated in June-August, when the south-east trade winds are fully established.

Foraging sites Seagrass pastures exist along much of the Kenya coast, being best-developed from Mombasa north, and provide important C. mydas feeding grounds (Frazier, 1974).

Migration No information is available, but it seems possible that turtles from the North Yemen nesting population, known to forage in Somali waters, may extend into Kenyan territory.

POPULATION: <u>Eretmochelys imbricata</u>

Nesting sites Little detailed information is available; low-level nesting appears to occur on widely-distributed islands and mainland beaches (Frazier, 1975a, 1975b and 1982).

Nesting numbers An estimated 50 E. imbricata nest annually (Frazier, 1982).

Trends in nesting numbers Frazier (1974) stated that nesting and breeding numbers had been reduced in recent years (i.e. the 1960s and early 1970s); Frazier later (1982) stated that numbers "seem likely" to have been reduced. No detailed information on trends is available. The presumed decline of Kenyan turtles generally was attributed to persistent exploitation, coastal development and pollution (Frazier, 1982).

Nesting season Nesting is suspected to occur mainly during the north-east monsoon (Frazier, 1982).

Foraging sites Little site-specific information is available, but the species may be expected to forage widely over Kenyan coral reefs; Frazier (1974) cites Shimoni, Malindi, Tenewi and Lamu as being particularly rich coral reef areas.

EXPLOITATION

Commodity Marine turtles serve as a source of meat, eggs and oil to the coastal people in Kenya. The shell of _E. imbricata_ and the meat of _C. mydas_ have in the past supplied an important export trade (Frazier, 1974).

Hunting intensity Outside national parks, where some protection is given, it is thought that few nesting turtles survive human predation. Frazier (1980a) reported that poaching was widespread but probably accounted for fewer than a few hundred turtles a year.

Hunting methods Most turtles are captured on the nesting beaches, but the people of the Bajun Islands to the north have a long tradition of hunting turtles off shore, and use nets and remoras for this purpose (Travis, 1967; Ray, 1969).

Historical trends Frazier (1980a) considered that the Barjun people historically probably took a few hundred turtles a year. Elsewhere turtles were probably eaten "when they were encountered". From 1952 to 1964, two brothers, D.G. and R.B. Whitehead, exported turtles from Kenya to Europe, although some of the turtles may have been caught off the Somali coast. Department of Fisheries statistics indicate that up to 1000 but usually fewer than 500 turtles were exported a year (Frazier, 1980a). However, Parsons (1962) claimed that 1000-1500 were exported annually between 1954 and 1959, and Travis (in Goodwin, 1971) estimated that 2400-2800 may have been exported a year. He said that after the war, the turtle fishing skills of the Kisingitini people were enlisted by commercial concerns, and that within five years the Kenyan turtles were reduced to near extinction (Travis, 1967). Parsons (1962) also mentioned that a plant to extract turtle oil was set up in 1951, followed the next year by a turtle soup cannery. By 1954, this plant was taking 200 turtles a year. Controls on turtle capture were introduced in 1959, with a licensing system, under which only 23 skippers held licences in 1958 (Parsons, 1962). Frazier (1980a) said that _C. mydas_ became totally protected in 1962, but Ray (1969) reported that fishing licences were issued for a total of 40 turtles at the time of his writing, although he estimated that up to 240 may have been taken the previous year.

Domestic trade Frazier (1980a) reported that in the early 1960s turtles were sold by the fishermen for US$8 each, bringing a price of US$30 to the exporter. Meat was still sold to the coastal people in 1980 and the shells to tourists (B. Kendall _in litt._, 4 July 1980).

International trade The East African Hawksbills have probably contributed to the tortoiseshell trade of antiquity, but it is not known how important the turtles from Kenya itself were (Parsons, 1972). A major export of live turtles and frozen meat to Europe started after the end of World War II (see above), and for a while this constituted the major source of turtle meat in England (Parsons, 1962).

Kenya ratified CITES on 13 December 1978, and has not reported any trade in turtle products. However the CITES Annual Reports of the importing countries have indicated sporadic trade in shells and stuffed turtles with Kenya, amounting to six _E. imbricata_ and five _C. mydas_ since 1976.

Customs statistics indicate that Kenya has continued to export tortoiseshell long after _E. imbricata_ became protected in the country. Kenya's own Customs statistics indicated exports of 1661 kg, 872 kg and 761 kg of shell

to Japan in 1976, 1977 and 1978 respectively (Wells, 1979). Japan's import statistics (Table 108) showed sporadic imports up until 1972, and then more or less increasing quantities up until 1985. Most of the shell was Bekko (E. imbricata) but there was also some other tortoiseshell. When questioned by TRAFFIC(Japan) about these exports, the Kenyan CITES Management Authority confirmed that it had not issued any export permits for turtle shell.

Table 108. Imports of tortoiseshell from Kenya reported in the Customs statistics of importing countries (in kg). No imports from Kenya were reported in the years not listed.

Year	1953	1955	1961	1962	1967	1969	1970	1971	1972	1973	1974	1975
Japan Bekko	77	11	18	81	44	34	0	38	183	1744	84	1169
" Other shell	–	–	–	–	0	0	12	0	0	0	0	0
Singapore	–	–	–	–	–	–	10	0	0	0	0	0

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Japan Bekko	2654	2655	2850	2051	463	1404	572	938	2111	3110	400
" Other shell	58	0	0	0	0	0	715	0	429	–	–
Hong Kong	0	98	0	0	0	0	0	0	0	0	0

LEGISLATION

Wildlife (Conservation and Management) Act 1976, 10 February 1976.
C. mydas and E. imbricata, including their eggs, are totally protected.

POPULATION: Chelonia mydas

Nesting sites According to Anon. (1979c), C. mydas nests in most islands in Kiribati, although no details of sites are provided. Anon. (1979c) stated that turtles (C. mydas is the most common) have been "seen, caught or known to nest" in 15 of the 16 islands in the Gilberts group, and while most encounters are at sea, not on a nest beach, some apparently low-intensity nesting is reported on remote beaches on most islands. The Phoenix and Line island groups are very sparsely inhabited and hence turtle populations are poorly-known. Anon. (1979c) was able to gather very few turtle records from the Line Islands, but suggested that good numbers may occur in view of the infrequency of disturbance, although nesting is thought to be sparse. Balazs (1982c) cited reports of apparently sparse nesting on Fanning and Christmas. In the Phoenix Islands, mating C. mydas were seen at Gardner Island in June 1978 (Anon., 1979c), nesting is known on Canton and is also reported on Enderbury, Hull, Birnie and Sydney (Balazs, 1975).

Nesting numbers Numbers appear to be low in the Gilberts and Line Islands, but may be somewhat greater in the Phoenix group. In the Gilberts, "good numbers" are reported only on Katangateman Sandbank north-east of Makin and on another bank near Nonouti (Anon., 1979c).

Balazs (1975) visited Canton (Phoenix group) on 13-20 February 1973. He recorded C. mydas nesting at four locations, extending for 2.1, 2.7, 0.4 and 3.1 km. Site 1 held two nesting females on one night, with two fresh sets of tracks on a subsequent night, and 16 tracks probably made within the past 10 days. Site 2 had one set of fresh tracks (with a further 13 reported in June 1973) and more than 100 nest pits thought to be two or three months old (i.e. nesting in November-December); Site 3 had over 30 pits of the same age. Site 4 had more than 40 pits and four fresh tracks. Balazs (1975) suggested that "a fairly large number of animals may be involved" in nesting at Canton, and was told that nesting at Enderbury is "heavy" in October-November.

Teebaki (1986) visited Canton (Kanton) in April-August 1986 and found nesting only at one site in the south-east, apparently not corresponding to any of the locations mapped by Balazs (1975: Fig. 1), but a little to the south of his Site 1. Nesting was found on one sandy portion of a 2-mile (3.2-km) section of beach fragmented by deposits of coral rubble and "base-cemented slabs"; some 20-30 suspected nests were recorded (some of this total may well comprise trial pits). Signs of emergence by one turtle, but no nesting, were seen on the southern rim of the atoll. Anon. (1979c) suggests, on the basis of Balazs's 1973 findings, that a minimum of ten females nightly may nest on Canton, and if April, June and October-December are the main nest months, some 160 may have nested yearly in the 1970s. Balazs (1982c) suggested the annual total may be as high as 200 (see next paragraph). No data are available for Gardner, Sydney, Hull or Enderbury; beaches on Birnie were seen to be "covered with turtle tracks" during a January 1978 flight (Balazs, 1982c).

Trends in nesting numbers A comparison of the reports of Balazs (1975; visit in 1973) and Teebaki (1986) suggests that nesting has declined on Canton; even though Teebaki's visit took place longer after the suspected main nest period than that of Balazs, some signs of nesting at the level reported by Balazs might be expected to persist if originally present. Balazs (1975) speculated that nesting populations are depleted on Hull, Sydney and Gardner following heavy exploitation during Gilbertese tenure of the islands. Little information is available on suspected trends in the

Line and Gilbert groups; Balazs (1982c) cited reports that turtles abounded at Fanning (Line group) in the 1850s, but are now seen only in small numbers, and similarly, that very large numbers occurred on Christmas at the time of Captain Cook's visit in December 1777, but after years of exploitation and human disturbance such numbers no longer occur.

Nesting season Whilst sporadic nesting reportedly occurs throughout the year on Canton there appears to be a distinct main nest period in October-November (Balazs, 1975); similar conditions seem likely to apply throughout Kiribati. Anon. (1979c) reported a second peak in April-May.

Foraging sites Green Turtles appear to occur widely in Kiribati (Anon., 1979c); for example, being seen commonly at Canton, either in the lagoon or over the reef on the ocean side of the atoll (Teebaki, 1986). No information is available on the relative importance of the various islands in terms of feeding habitat.

POPULATION: Eretmochelys imbricata

According to Anon. (1979c), the Hawksbill is common in Kiribati, but no corroborative details are provided. Nesting has not been recorded on any of the inhabited islands but might be suspected to occur on those that are not inhabited. The species has been recorded at sea in the Tarawa lagoon, and (although the source cited is not consistent) at Butaritari and Kuria and some of the other northern Gilberts (Anon., 1979c). According to B. Yee Ting (in litt., 3 September 1986) the species may not nest in Kiribati.

THREATS

Whilst exploitation of turtle eggs (apparently) and of foraging and nesting turtles (certainly) appears to be widely practised, it appears generally to be of low intensity and primarily non-commercial, and is probably not currently a major threat. However, the introduction of nylon nets has improved the efficiency of capture and the demand for meat is growing in step with the increasing human population. Past exploitation, including on Kintimati, Sydney and Hull, may have been intense on occasion; the statement (Balazs, 1982c) that residents on Fanning take turtles "whenever possible" suggests that it may be of more than minimal significance in parts of Kiribati. The US occupation of Canton has resulted in considerable beach disturbance (Teebaki, 1986), and the use of Kirimati (Christmas) for nuclear weapons testing by UK and USA seems likely to have had an impact on turtle populations. Feral cats and domestic pigs on Canton seem unlikely to pose a significant threat to nesting turtles.

EXPLOITATION

Commodity Both turtle eggs and meat constitute important items of diet in Kiribati, though they are eaten less often than fish. They are considered as totem creatures, and there are several traditional constraints on eating them. E. imbricata is sacred in some areas and is not often caught by divers. This may be linked to the fact that there are two reported cases of fatal poisoning following consumption of Hawksbills. Most turtles are caught for subsistence purposes, but some divers are said to catch turtles primarily to sell the carapace (Anon., 1979c).

Hunting intensity Tarawa, Butaritari, Kuria, Aranuka and Nikunau are five of the main areas for turtle fishing. In Tarawa, some 5-10 C. mydas are netted each day at the northern end, and a further 1-3 at the southern end. The average daily catch at Butaritari is 3-10, about half of which are C. mydas. Ten turtles, seemingly C. mydas, were caught in one trip at Butaritari in 1985 (B. Yee Ting in litt., 3 September 1986). An exceptional catch of 45 turtles was made in 1973. Most of the turtles are in the 50-90 cm size range. At Betio (Tarawa) and Abemama, where turtles are speared, some 2-5 turtles, mostly C. mydas, are caught each day. Divers can catch about 2-3 turtles a day, though in good areas such as Teaoraereke (Tarawa), up to 12 can be caught. The total subsistence harvest of turtles on Tarawa (Table 109) was estimated from the numbers of known fishermen and their average catches during the peak four months' season (Anon., 1979c). Balazs (1975) reported that few turtles were taken on Canton Islands owing to the strict enforcement of conservation regulations by the military personnel. However local ships visiting Gardner, Hull and Canton Islands are said regularly to return with barrels of salted turtle meat (Anon., 1979c). People on Fanning Island are said to take turtles whenever possible (Balazs, 1982c).

Table 109. Subsistence harvest of turtles in Tarawa, estimated from the number of hunters and the average daily catch during the peak four months' fishing season (Anon., 1979c).

Method	No of Hunters	Turtles per day	Turtles per year
Net	12	3	576
Harpoon	6	2	48
Diving	5	2	40
Nesting	2	1	2
Total	25		666

Hunting methods Turtles are occasionally turned on the nesting beaches. In the Gilberts group there are many intricate methods of determining, from the number and state of development of the eggs, the day on which the female will return to lay. Coconut twine nets were used in Butaritari (Northern Gilberts) but monofilament nets are becoming more popular, and their use is spreading to other areas. Nets are 80-120 fathoms (150-220 m) long, with a mesh size of 50 cm; they are usually set in the lagoons near the seagrass feeding grounds. Harpooning is another popular method, particularly at Betio (Tarawa) and Abemama, and is usually carried out at night, though power boats and pressure lamps are replacing canoes and leaf torches. Ripe pandanus fruits are sometimes used as ground baits to attract turtles. On the steep reef-front on the ocean side of the islands, turtles are caught during the day as they rest in coral crevices. Divers descend with ropes tied to log floats, which they tie or hook into the turtles (Anon., 1979c).

Historical trends Increased demand for turtle meat and shell is said to have caused an increase in fishing effort. Eighty percent of the turtles in Tarawa are now caught by nets, a method which has increased in popularity in recent years, and which allows much greater daily catches (Anon., 1979c). Christmas Island was discovered by Captain Cook in 1777, and his reports of

catching 200-300 Green turtles during eight days is said to have attracted numerous vessels to stop there for provisions during the 19th century. Other remote islands are said to have been visited by foreigners hunting for turtles (Balazs, 1982c).

Domestic trade Very little turtle meat is sold, but the price at the Local Produce Division is $0.50 a lb ($1 a kg). Carapaces of 40-50 cm length sell for $8.00 each. Apart from Tarawa, the only other area with significant trade in carapaces is Kuria (Anon., 1979c).

International trade Some of the turtle carapaces sold are said to be destined for export and this market is growing (Anon., 1979c). Fijian Customs statistics (q.v.) report imports of worked tortoiseshell products from Kiribati in 1973, 1975, 1977 and 1978.

Kiribati is not a Party to CITES, and no trade in turtle products has been recorded in the Annual Reports except for leather products imported to and re-exported from Italy in 1982 and 1983. This appears to have been due to a misapprehension on the part of the Italians that "KI" was the code for Cayman Islands, where all the leather is believed to have originated.

RANCHING

Subsistence level rearing of turtles is said to be "common practice" in Kiribati, when turtles are caught in excess of family requirements or when they are needed for future feasts. They are kept in pools or enclosures, and are fed on leaves, coconut, fish, seaweeds and grass. Hatchling turtles are occasionally reared on a diet of small bivalves, but this is not generally thought to repay the effort. On Taratai (Tarawa) a farmer was reported to have raised 50-60 C. mydas in an enclosed lagoon for 12 months, allowing them to feed naturally on mangroves and algae. During six months they grew from 15-20 cm to 40-50 cm. Another man was said to have grown a Green Turtle from 30 to 95 cm over a period of five years, feeding it on coconut and Portuluca (Creeping Grass) (Anon., 1979c).

LEGISLATION

Wildlife Conservation Ordinance 1975, 29 May 1975

The taking of any wild turtle on land is prohibited except under licence.
The taking of C. mydas is prohibited in some areas.
The possession of species, their products or eggs which have been illegally acquired is prohibited.

POPULATION

While sea turtles may be expected to occur in the waters around Korea, no evidence has been found to confirm this, nor whether any nesting occurs.

International trade The Republic of Korea is not a Party to CITES. CITES Annual Reports indicate the import to the USA of a total of eight turtles between 1977 and 1984 from Korea. In 1984, F.R. Germany recorded the commercial export to Korea of 58 kg of C. mydas meat said to have originated in Nicaragua.

Korean Customs statistics record the import and export of several categories of raw and worked tortoiseshell, but the chief trade is the import of worked shell (Table 110) and the export of worked products (Table 111). The chief source of raw shell has been Indonesia and the chief destination of the worked shell was Japan. Neither the Indonesian nor the Japanese Customs reports confirm this trade in comparable quantities. This may indicate that the shell is not of sea turtles, but it is difficult to see what other "worked tortoiseshell" products could be exported.

Table 110: Sources of imports of "Tortoiseshell and plates" 05090501, and "Claws and waste of tortoiseshell" 05090599 reported in the Customs statistics of the Republic of Korea (kg).

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Brunei	-	-	-	-	-	-	-	-	-	-	-	-
Burma	300	-	1100	500	-	-	-	-	-	-	-	-
China	-	600	-	-	-	-	1000	-	3500	500	-	1900
Hong Kong	600	-	-	500	-	-	2255	-	-	-	-	-
India	-	-	-	-	2370	600	-	700	-	-	-	-
Indonesia	4300	5500	3900	4103	10319	9000	6300	12270	14400	6806	9191	11800
Japan	5	-	-	-	500	-	-	-	-	-	-	-
Malaysia	300	-	-	600	500	-	-	-	1000	1500	-	-
Switzerland	-	-	-	-	1330	-	-	-	-	-	-	-
Thailand	900	-	1100	520	1500	-	-	-	1300	-	1150	-
Viet Nam	600	-	-	-	-	-	-	-	-	-	-	-
Others	-	-	-	-	-	-	-	-	1300	3500	5830	8975
Total	7005	6100	6100	7333	18029	9600	10555	12970	21500	12306	16171	22675

Table 111. Destinations of exports of "Worked tortoiseshell" 95050202 reported in the Customs statistics of the Republic of Korea (kg).

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Australia	–	–	–	–	–	–	–	0	9477	–	–	–
Canada	–	–	–	–	–	–	–	0	132	1210	–	–
China									8			
France	–	–	–	–	440	20	–	–	–	–	–	–
Japan	352	–	–	–	548	1668	4750	1965	16993	17405	98	6
Germany FR	–	–	–	–	35	358	–	337	–	–	–	–
Hong Kong	–	–	–	–	–	–	–	137	600	–	–	–
Italy	–	–	–	–	30	–	–	225	–	–	–	–
Singapore	–	47	–	–	–	–	–	–	–	–	–	–
Spain	–	–	–	–	–	–	–	–	54	–	–	–
UK	–	–	–	–	–	–	80	–	–	–	–	–
USA	46	15	85	–	597	653	117	29	1444	2562	–	112
Others						100						
Total	398	62	85	0	1650	2799	4947	2963	28708	21177	98	118

In 1982 only, worked tortoiseshell was classified as category 95050201.

KUWAIT

Very small numbers of Green Turtles and Hawksbills occur in Kuwaiti waters, and nest on Um Al-Maradam and Garu (= Qaru) islands. A total of 126 nests were recorded in 1985 (A.L. Al-Zaidan in litt., 22 September 1986; species identification not available), suggesting an annual nesting total of around 40 females. Moves have just been initiated to protect marine biota from nylon nets and other marine debris (A.L. Al-Zaidan in litt., 22 September 1986).

EXPLOITATION

The Department of Fisheries Resources has indicated that there is no local utilisation of turtles and no international trade (A.L. Al-Zaidan in litt., 22 September 1986).

Indian customs export statistics indicated that 50 050 kg of tortoiseshell were exported to Kuwait in 1977.

LEGISLATION

There are no legislative controls on turtle exploitation (A.L. Al-Zaidan in litt., 22 September 1986).

Some nesting by C. mydas has been reported along most of the Liberian coast, between Robertsport and Harper (A. Peal in litt., 15 September 1986), but no information is available on specific sites or on nesting numbers. Loveridge and Williams (1957) cite Angel River, but it is unclear if this is a nesting record. Nesting abundance is rated "low" (Peal in litt., 1986). No recent information is available on E. imbricata, although Johnston (1906, cited by Loveridge and Williams, 1958) mentioned that this species was eaten (in the 1900s) by the Africans in Liberia but not by the Europeans. C. mydas is exploited for subsistence purposes (Peal in litt., 1986).

International trade Liberia acceded to CITES on 11 March 1981. There is no record of trade in turtle products with Liberia recorded in CITES Annual Reports.

LEGISLATION

Draft: Forestry Development Authority Regulation. Wildlife Conservation Regulation. (No date)

C. mydas is fully protected. Export of the species and trophies is prohibited.

POPULATION: Chelonia mydas

Nesting sites Vaillant and Grandidier (1910) state that sea turtle nesting in Madagascar is largely restricted to the western coast, including the north-west, and the north-east, where sheltered bays, coves and coral islands are widespread. Similar statements are made by Petit (1930), Decary (1950), and others. At the present time, Madagascar appears to be considerably more important for foraging C. mydas populations than for nesting. Published information on C. mydas nesting in Madagascar is sparse. According to Hughes (in litt., 2 April 1987) Green Turtles do nest on mainland Madagascar, but only sporadically in scattered localities, and there are no known mainland nest beaches of any significance. Hughes (1974; Fig. 5) indicates reputed or sporadic nesting at two points on the south-west mainland coast, also on Chesterfield, and minor nesting in the Barren Isles, both sites off the mid-west coast of Madagascar. Bonnet (in litt., 22 April 1987) confirmed that sparse nesting occurs on the mainland south of Toliara, but noted the lack of nesting on Nosy Vé in summer 1986. Frazier (1975) reported very sparse nesting on two islands off the north-west of Madagascar: Nosy Mitsio and a cay off Nosy Iranja.

Nesting numbers Very little detailed information is available. At present, nesting appears to be at low to moderate levels on the islands; no evidence of confirmed mainland nesting could be found. Hughes (1976) cites estimates of 300 females annually on Chesterfield and 200 in the Barren Isles. Frazier (1975), after a very brief field survey, suggested around 100 females nested annually on the north-west islands, almost all of these on Nosy Iranja.

Trends in nesting numbers No detailed information is available. Writing between the First and Second World Wars, Petit (1930) stated that sea turtle populations around Madagascar were declining. This decline was attributed to the intensive fishery and systematic collection of eggs; according to Petit, turtles were abandoning the mainland coast in favour of the offshore islets. Frazier (1975) implied that nesting numbers have declined markedly. However, no comparative data by which to assess nesting trends appear to be available. As noted by Frazier (1975: 174), many early narrative and other accounts do suggest that large numbers of turtles existed around Madagascar (see, for example, the footnote in Vaillant and Grandidier, 1910, concerning Mariano's visit in 1613-1614), however, it is by no means clear to what extent such accounts refer specifically to nesting turtles, and foraging numbers appear still to be relatively high.

Nesting season Vaillant and Grandidier (1910) report that sea turtles in general in the Madagascar region nest in September-February, especially in November-January.

Foraging sites The species was reportedly common in Malagasy waters in the 1970s; however, the great majority of these animals appear to feed around the coast but breed elsewhere. Suitable foraging grounds are particularly extensive along Madagascar's western seaboard, where waters are typically clear and sheltered, and coral reefs enclose shallow lagoons rich in seagrasses and algae. These shallows are a major C. mydas foraging ground, and also the hunting ground of the coastal Vezo and Sakalava peoples, who harvest very substantial numbers annually (Hughes, 1974 and 1975).

Migration Thirteen of 4843 female C. mydas tagged on Europa (Mozambique Channel) have subsequently been recovered from Madagascar waters; on this

evidence, Europa must make a very substantial contribution to Madagascar's foraging population. Females tagged in Tromelin have also been recovered from Madagascar (also Réunion and Mauritius). See REUNION account for further details.

POPULATION: Eretmochelys imbricata

Nesting sites Vaillant and Grandidier (1910) state that sea turtle nesting is largely restricted to the western coast, and around the northern coast, where bays, coves and coral islands are widespread. These authors cite Megiser (1609), who stated that E. imbricata is found only in the west, notably around the scattered islets, and in the north-east, as far south as Ile St Marie. Presumably the E. imbricata found on a beach a few km north of Tsimanandrafozana (Douliot, cited in Vaillant and Grandidier, 1910) was attempting to nest. Petit (1930) reported that Nosy Chesterfield was a site much favoured for hunting turtles; some of these seem likely to have been females taken on the beach. Little more recent site-specific information is available. According to Hughes (1973a and 1974) major nesting occurs around the northern third of Madagascar, with the north-east coast perhaps being most heavily used. Hughes (1974: Fig. 5) indicated reputed or sparse nesting at two points on the south-west coast, possibly Nosy Hao and Nosy Vasy, as reported in Hughes (1973a: 115). Frazier (1975) records very minor nesting on Nosy Kalankarjoro, an islet in the north-west.

Nesting numbers No quantitative nesting data are available. Although the species has been said to be abundant around the coral islands off the west and north-west coasts (Vaillant and Grandidier, 1910), it is not clear to what extent such estimates refer to nesting populations. Hughes (1974) suggests that nesting may be moderately aggregated in northern Madagascar, and the fact that an estimated 2500 E. imbricata were being harvested annually in Madagascar in the early 1970s (mainly juveniles, and mainly taken in the south-west) (Hughes, 1973a, 1974) might be taken to imply that very substantial numbers nest. Frazier (1975) suggested that only a dozen females may nest annually on Nosy Kalankarjoro.

Trends in nesting numbers Writing between the First and Second World Wars, Petit (1930) stated that sea turtles were declining in numbers around mainland Madagascar, but were still in evidence around the offshore islands, perhaps increasingly so. Figure 14 in Petit (1930; figure reprinted in Hughes, 1973a) shows a rather steady decline in exports of E. imbricata shell from over 4000 kg in 1919 to 1440 kg in 1928 (see Table 113). It is not clear to what extent this may be due to declining demand rather than to declining numbers of turtles. Hughes (1973a) calculated that the 1919 total represents some 1600 adult turtles (given a yield of around 2.5 kg per turtle). Petit regarded this decline in export volume, coupled with a sharp decline in the size of individual E. imbricata caught, as indicating a steep decline in the local E. imbricata population. Hughes (1973a) cited these same data and concluded that decline cannot be attributed to any factor other than over-exploitation.

Whilst the evidence for a marked decline in E. imbricata populations over the first three decades of the 20th century is rather persuasive, there seems to be no clear evidence for the continuation of that trend through the post-World War II years. Hughes's estimate of 570 adult Hawksbills killed in 1971 is almost exactly equivalent to the 576 which may have produced the 1440 kg of shell Petit (1930) recorded as being exported in 1928 (given 2.5 kg of shell per turtle). The available information (Petit, 1930; Hughes, 1973a) suggests that while the recorded export of raw shell has

declined through the 20th century, national production of worked shell and of stuffed juvenile turtles for sale to tourists has risen in recent decades. Hughes (1973a: 117) suggested that either there is a balance between exploitation and recruitment, with overall exploitation at a similar level in the 1970s as in the inter-war years, or the fishery effort has increased. Hughes (1973a) reported that there is no evidence that fishery effort has in fact increased, and further, that some fishermen in the north-west claimed that E. imbricata numbers were increasing. Whilst there appears to be no hard evidence for a decline in Hawksbill numbers over recent decades, the apparent increased harvest of immature turtles may be expected to have a long-term effect on population structure.

Nesting season Vaillant and Grandidier (1910) state that sea turtle nesting in general in Madagascar occurs in September-February, particularly in November-January, but this may well be applicable more to C. mydas than to E. imbricata.

Foraging sites Much suitable foraging habitat exists, primarily along the western seaboard, where coral reef development is extensive. According to Vaillant and Grandidier (1910) E. imbricata abounded around the coral isles off the west and north-west coasts, where food was similarly abundant.

THREATS

A decline in sea turtle populations evident, according to Petit (1930), in the inter-war years, was due to intensive harvest of adults (for food, oil, and tortoiseshell) and eggs. Exploitation appears to remain relatively intense today, and may constitute a threat to populations. However, Hughes (1975) believes that C. mydas, at least, may be little-affected, since the harvest is mostly of foraging animals not solely of nesting females.

EXPLOITATION

Commodity Sea turtles and their eggs are exploited extensively around the coasts of Madagascar. The main species for human consumption are C. mydas and C. caretta. E. imbricata has been the victim of a long-term fishery for shell. Its meat is usually discarded, although it may be eaten by the very poorest people. There are no documented incidents of poisoning, but a law prohibiting the sale of Hawksbill meat was passed in 1884, apparently as a result of numerous poisonings on the island (Hughes, 1973a). Decary (1950) reported that there was much superstition surrounding the capture and eating of turtles, and that women were formerly not allowed to eat the meat, although this practice had been abandoned. The oil was said to be used as a cure for phagedenic ulcers (Decary, 1950).

Hunting intensity Hunting is most intense around the south-west of the island. Estimates of the harvest were made by Hughes, and the data were subsequently re-analysed by Frazier (1980). These are presented in Table 112. Harvests of C. caretta and L. olivacea were estimated to be 2014 and 2400 respectively, with a combined weight of 289 300 kg; thus 72% of the edible turtle meat harvested (i.e. excluding E. imbricata) is derived from C. mydas. Rabesandratana (1985) reported that the annual consumption of turtle meat in Morombe, a district on the west coast, was about 2.5 t between 1979 and 1984, with a peak of 5.3 t in 1983. Eggs are much relished, but the intensity of collection is not known. Rakotonirina (pers. comm. to Bonnet, cited in litt., 22 April 1987) reported that about two C. mydas were landed weekly at Toliara and one daily at Itampola.

Table 112. Estimated annual harvest of C. mydas and E. imbricata in Madagascar, compiled by Frazier (1980) from the work of Hughes (1971-1973a). The value was estimated at US$0.43 a kg, assuming 50% of the gross weight is consumable.

Region	Estimated annual catch Juvenile	Subadult	Adult	Total Nos.	Gross Wt (kg)	Value (US$)
C. mydas						
S & SW	2245	1166	3411	6822	730145	156022
E. imbricata						
S & SW	1206	402	402	2010	38190	8161
Diego Suarez	400	?	40	440 +	5800 +	1247 +
NW	?	?	130	130 +	5850 +	1258 +
Tamatave	40	?	?	40 +	400 +	86 +
TOTAL	1646 +	402 +	572 +	2620 +	50240 +	10752 +

Hunting methods The most simple method of catching turtles is by turning them on the nesting beaches, which is necessarily chiefly practised in the north of the island, where most nesting occurs. Harpoons are used in the south-west, particularly by the Vezo tribe, who use a specialised turtle harpoon known as Teza or Samona. In the north-east, nets are often set along the reef front, to catch the turtles returning to the sea on the falling tide. In this region, grapnels are also dropped to hook turtles seen sleeping underwater. Fishing with Remora was once practised, as described by Decary (1950), but it is not widely used today (Hughes, 1973a).

Historical trends Turtle fishery has been carried out in Madagascar for many hundreds of years. In 1609, Megiser (cited in Vaillant and Grandidier, 1910) said that the Malagaches were ardent turtle hunters, and tortoiseshell was mentioned by Mariano (1613, cited in Decary, 1950) as one of the exports of Madagascar. Dumaine (1792, cited in Vaillant and Grandidier, 1910) said that the tribal people of the north-west coast fished for turtles around the offshore islands and sold shell to Arab traders. By the middle of the 18th century, the export trade had grown to some 4 t a year (see Table 113), and Hughes (1973a) concluded that some 1600 adult E. imbricata were being killed annually to support this. The exports declined dramatically between 1919 and 1928 to about 1.4 t a year (see Table 113) and this is probably an indication of increasing scarcity and decreasing harvests (Petit, 1930). By 1971, the volume of raw shell had declined to 250 kg, but a further 1145 kg of worked shell was exported. If all of this weight represents shell, and not mounting materials, such as wood, silver, etc, then the total volume of exports may have been similar to that in 1928, and the decline in raw shell exported merely reflects a growing indigenous shell carving industry. Hughes (1973a) pointed out that large numbers of small, stuffed turtles were being sold to tourists, and that this trade was almost certainly higher than it had been in 1928.

There are very few data to indicate how the harvests of eggs and of C. mydas and the other species used for meat have changed over the years.

Domestic trade Turtle meat sells readily in the coastal districts, and is sold in the markets at Morombe. Around Toliara most of the sales are

local, and it never reaches the markets (Rabesandratana, 1985). Frazier (1980) gave the price of meat as US$0.43 a kg.

Tortoiseshell was sold by the fishermen for as little as US$2 a kg in 1971, changing hands in the capital for twice that price. Export values were said to be US$20-56 a kg. There is a large domestic trade in small, stuffed turtles and in locally manufactured jewellery and trinkets. Hughes (1973a) estimated that about 1000 stuffed turtles were sold each year at an average price of FMG6000 (US$25.64).

International trade Madagascar has long been a major exporter of Hawksbill shell (see above) and the estimated exports are given in Table 113. Zanzibar imported about 330 kg a year from Madagascar between 1920 and 1964 (Frazier, 1980). More recent exports are indicated by the Customs imports figures of Spain and Japan (Table 114), but the levels have not been great. It appears that most of the shell harvested is now used in artisan industries on the island, the export of turtle products now being illegal. Considerable quantities of tortoiseshell jewellery apparently manufactured in Madagascar and exported illegally are to be seen on sale in Réunion (Luxmoore, 1987, unpublished).

Madagascar ratified CITES on 20 August 1975 and has reported exports of small quantities of turtle products, apparently as personal possessions, in most years (Table 115).

Table 113. Exports of tortoiseshell from Madagascar and the values of raw shell reported by various sources: 1863-1907 (Vaillant and Grandidier, 1910), 1919-1928 (Petit, 1930), "before the war" (Decary, 1950), 1971 (Hughes, 1973a). * in 1971, an additional 1175 kg of worked shell was exported.

Year	Total wt (kg)	Total value	Value/kg
1842			F5
1863	3000	F150000	F40-50
1869			F5-30
1897		F35201	
1901		F55597	
1906	3882	F139679	F36
1907	3335	F155470	F46.50
1919	4068		
1920	3550		
1921	2542		
1922	2226		
1923	2455		
1924	2282		
1925	1652		
1926	1917		
1927	1483		
1928	1440		
(before the war)	800-1000		
1971 *	250 (+ 1175)	FMG1750000	

Table 114. Imports of raw tortoiseshell (kg) from Madagascar reported in the Customs statistics of importing countries. 0 = No imports reported. – = Customs reports not available. Japan reported no imports from Madagascar between 1950 and 1970 or between 1977 and 1985, and all imports were reported as bekko.

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	....	1986
Japan (Bekko)	64	0	250	570	100	100	60	0	0	0	0	138
Spain	–	–	–	–	–	0	104	10	0	–	–	–

Table 115. All trade in C. mydas, E. imbricata or unspecified sea turtle products exported from Madagascar recorded in CITES Annual Reports since 1976. All reported by Madagascar, except the two imports to the USA.

Year	Species	Commodity	Importer	Purpose
1985	Cheloniidae	1 body	France	Personal
1984	Cheloniidae	1 body	France	Personal
	E. imbricata	7 carvings	USA	
1983	C. mydas	2 shells	USA	Illegal
1982	Cheloniidae	1 body	France	
	Cheloniidae	1 shell	France	
1981	Cheloniidae	2 bodies	France	
1980	Cheloniidae	2 shells	France	
	Cheloniidae	1 shell	India	
1978	C. mydas	1 body	France	
1977	Cheloniidae	2 bodies	Réunion	

LEGISLATION

Résolution, 24 December 1923.
Prohibits the capture of all marine turtles during egg laying, and of individuals of less than 50 cm plastron width ("largeur").

Ordonnance No. 60-126 (3 October 1960).
Establishes controls on hunting, fishing and the protection of fauna.

Arrêté No. 1316, 13 July 1961.
Establishes fees payable for the commercial hunting or collecting of wild animals, in accordance with Ordonnance No. 60-126. Sea turtles attract a duty of F250 each.

Loi No. 71-006, 30 June 1971.
Establishes export duties to be paid for the export of all live or stuffed specimens of wild animals. The duty for "other reptiles", which includes sea turtles, is F1000 each animal in excess of two.

Arrêté portant interdiction de la vente et de l'achat de tortues et de crocodiles empaillées ainsi que des produits obtenus à partir de ces animaux en vue de leur exportation. 25 February 1980.
Prohibits the selling or purchase for the purpose of export of stuffed specimens of sea turtles and of products thereof.

C. mydas occurs very occasionally at both the Azores and Madeira, but earlier records of there being a large fishery for this species probably result from a confusion with C. caretta. There is no record of C. mydas from the Selvagens Islands. E. imbricata is very rare at Madeira and the Azores, there being very few records (Brongersma, 1982). Brongersma (1968) reported earlier records (1932 and 1954) of one specimen of each species in the fish market at Funchal; these must be seen as incidental captures.

LEGISLATION

The islands of the Azores, Madeira and Selvagens are Portuguese territory, and are included in the EEC. They are covered by Portugal's ratification of CITES (11 December 1980).

Decreto Lagislativo Regional No. 18/85/M. 23 August 1985. (Madeira)

All capture, keeping and intentional killing of the following species is prohibited: C. caretta, E. imbricata, L. kempii, C. mydas and D. coriacea.

All internal or external trade in turtles or their products is prohibited.

MALAYSIA: SABAH

POPULATION: Chelonia mydas

Nesting sites The principal nesting beaches are on Pulau Gulisaan, P. Selingaan and P. Bakkungan Kecil, constituting the Turtle Islands National Park, in the Sulu Sea some 30 km north of Sandakan. Sparse nesting (not always confirmed to be by C. mydas) has been recorded at around 30 other sites, mostly on small islands (de Silva, 1969a). Tegapil and Lankayan in the north, and Sipadan (off Semporna) appear to be the most productive (data of Harrisson 1961-1964, in Polunin, 1975). The Turtle Islands N.P. lies entirely within Sabah territory; other islands in the group extend into Philippines territory (where turtles also nest).

Nesting numbers No quantitative surveys of nesting females have been carried out. Egg yield data (Table 116), however, can be used as a very approximate index of nesting numbers, given the assumption that most eggs laid are harvested; according to de Silva (1982) "practically every egg" on the turtle island beaches is harvested during dense nesting periods. The islands were privately owned until the end of 1972, during which time the right to collect all eggs for sale was leased out, and became the core of Turtle Islands N.P. in 1973, since when most eggs have been used for hatchery purposes. A count of C. mydas nests is available for 1982-1986; in these five years E. imbricata nests were on average 13.4% of the total nests counted, so all total egg yield figures before 1982 might be expected to include a similar proportion of E. imbricata nests (but the figures below have not been so adjusted). The mean annual number of C. mydas nests in 1982-1986 was 2633. The mean number of C. mydas tagged over the same period was 1375, giving an average of 1.9 nests per turtle tagged. Marsh (in litt., 18 September 1986) reported that between two and six C. mydas nested nightly in September on P. Sipadan. More sporadic nesting on P. Sipadan was reported by de Silva (in litt., 26 August 1988) and he pointed out that all eggs laid on the island were collected by locals under the terms of their "native rights". According to Harrisson (1964, cited in Polunin, 1975) some 110 000 eggs (probably mostly C. mydas) were probably collected in other islands in north and south-east Sabah in 1961-1964; assuming this is an annual average, an additional 350 females might have been nesting in Sabah outside the Turtle Islands.

Trends in nesting numbers While the egg yield data need to be interpreted with great caution, they do suggest that a moderately steady decline in nesting effort, of around 45%, has occurred over the past two decades, most evident from the mid-1970s onward. The 1986 egg harvest was 51% of the 1965 harvest and only 34% of the 1947 harvest, but it is not clear how reliable the yield record for the latter year is. Those closely familiar with the situation in the field have stressed that turtle populations had declined significantly over this period and were severely threatened (de Silva, 1982; in litt., 3 September 1986).

Nesting season Nesting occurs on the three turtle islands virtually throughout the year, but most takes place in August-October, with a peak in September (de Silva, 1969a, 1969b).

Foraging sites Although the species may occur widely in Sabah waters, no information on favoured feeding grounds is available. C. mydas have been recorded around the Semporna group of islands, off Sabah's east coast (Wood,

1982a), these were presumably foraging turtles since no nesting appears to occur there.

Table 116. Egg harvest on Pulau Selingaan, P. Bakkungan Kecil and P. Gulisaan. Data up to 1978 are from de Silva (1982) and for 1979-1985 from de Silva (in litt., 3 September 1986); 1976 data are omitted because they are said to be inaccurate (the eggs having been removed by Forest Department staff), and most pre-1965 data are similarly omitted as "scanty and unreliable" (de Silva, 1969a). The reported 1947 yield (de Silva, 1984) is given for comparative purposes. Chan Eng-Heng (in litt., 1 August 1988) provided the data for 1986 and for the numbers of turtles tagged.

Year	Total egg harvest	*C. mydas* nests	*C. mydas* tagged
1947	706 960		
1965	475 450		
1966	365 430		
1967	677 275		
1968	298 797		
1969	650 330		
1970	539 593		
1971	459 700		
1972	406 059		
1973	510 272		
1974	368 430		
1975	380 294		
1977	311 941		
1978	322 102		
1979	387 228		
1980	333 251		
1981	285 853		
1982	302 383	2978	1349
1983	234 873	2243	1035
1984	297 195	2886	1523
1985	248 628	2457	1268
1986	242 813	2599	1699

Migration More than 16 000 females have been tagged on the turtle island rookeries since 1970; only 14 international recoveries have so far been reported, nearly all *C. mydas* (de Silva, 1986, in press). Two tagged turtles were recaptured in Indonesia - at Kai Kecil (in Kai group, eastern Moluccas) and Cempedek Island (south-east Sulawesi), distances of 1556 and 1305 km, respectively. The remainder were recorded in the Philippines, mainly around the central islands.

The following tag records are of interest in demonstrating intra-island group nesting shifts, although they are not strictly migratory movements. One female tagged on P. Bakkungan Kecil nested there three times in 1979, once in 1980, and twice in 1982, but in 1983 shifted 38 km to nest on Baguan in Philippines territory. Similarly, a female tagged originally while nesting on 5 June 1983 on Bakkungan Kecil, returned to nest again on 17 July

1983 bearing a Philippines tag in addition, presumably having beached on a Philippines island meanwhile; it nested on Bakkungan Kecil for a third time on 27 August 1983. See migration section in the PHILIPPINES account.

POPULATION: *Eretmochelys imbricata*

Nesting sites Confirmed nesting is recorded from Pulau Gulisaan, P. Selingaan and P. Bakkungan Kecil, constituting the Turtle Islands National Park, in the Sulu Sea, some 30 km north of Sandakan. Nesting is also known on P. Tegapil (de Silva, 1969b) and sporadic nesting appears to occur elsewhere, including the Semporna Islands (Harrisson, cited in de Silva, 1969b), the Kudat District and P. Belian (de Silva, 1969a).

Nesting numbers The following data are provided from the Turtle Islands N.P. by de Silva (*in litt.*, 1986). The available evidence suggests that Gulisaan is probably the most important *E. imbricata* site in Sabah. A mean of 152 *E. imbricata* a year were tagged from 1982 to 1986, producing an average of 2.3 nests each (Chan Eng-Heng, *in litt.*, 1 August 1988).

Table 117. *E. imbricata* nestings in the Turtle Is. N.P. (de Silva, *in litt.*, 1986), with the number of *E. imbricata* tagged (Chan Eng-Heng, *in litt.*, 1988).

	P. Selingaan	P. Bakkungan Kecil	P. Gulisaan	Total	*E.imbricata* tagged
1979	12	69	348	429	
1980	27	78	400	505	
1981	62	39	384	485	
1982	50	28	308	386	108
1983	74	29	297	400	159
1984	68	19	351	438	200
1985	58	12	229	299	150
1986				244	144

Trends in nesting numbers The data in the table above show no clearly-definable trend in nesting numbers at the sites represented. No data are available for sites outside the Turtle Islands N.P. However, some authorities (de Silva, 1969a, 1969b, 1982 and 1984) familiar with the field situation believe that turtle numbers have declined over the past couples of decades, and that turtles are severely threatened in Sabah. Some control of *E. imbricata* harvesting was attempted in the 1920s and 1930s, possibly indicating a perceived decline in numbers.

Nesting season Some nesting appears to take place virtually throughout the year in the Turtle Islands N.P. It is difficult to distinguish well-defined peak nesting periods, though it seems to be at a minimum in September-December and at a maximum in January-June (de Silva, unpublished data, *in litt.*, 1986). Peak nesting intensity does not appear to be synchronous on the three islands.

Foraging sites No detailed information is available on preferred foraging sites.

Migration Little information is available, but one long distance movement is known involving a turtle tagged in P. Bakkungan Kecil recovered 40 days later, some 713 km away in the central Philippines.

EXPLOITATION

Commodity Turtle eggs are avidly consumed by the people of Sabah, but the consumption of meat is not widespread, owing to the Muslim beliefs of most of the population. It is generally only eaten by some ethnic minorities, such as the Rungus Dusuns of Kudat, and immigrant communities such as the Cocos Islanders and Chinese. There is some slaughter of Hawksbill turtles for their shell for barter to overseas traders (de Silva, 1982).

Hunting intensity On unprotected beaches, eggs are still heavily collected, and it is probable that the majority of clutches are removed. Within the Turtle Islands National Park, most of the clutches are protected, although a small percentage may be removed by poachers. Hunting of adult turtles at sea around Sabah's international boundary is largely uncontrolled, owing to the presence of armed fishermen and pirates. The coastal people around Kota Belud and Kudat kill some nesting turtles, and have been accorded Native rights to collect eggs (de Silva, 1982). Some eggs are collected by National Parks Department staff for their own use (de Silva in litt., 26 August 1988).

Hunting methods Native peoples have the right to collect eggs in specified areas. These include the mainland coast from Kimanis Bay to Kota Kinabalu, the whole of the Kota Belud, Tawau and Kudat districts and the islands of Tiga, Gaya, Sipadan, Mantanani Besar, Mantanani Kecil, Langgissan, Usukan, Silar, Pandan-Pandan and Egot. Commercial egg collecting licences are granted for various islands listed as "turtle farms". These now include Pulau Tegapil, P. Lankayan, P. Bilean, P. Koyan Koyan, and P. Nunu Nunukan (de Silva, 1984). Methods of deliberate turtle hunting, other than capture on the nesting beaches, are not documented. Turtles are caught accidentally in fishing gear and by dynamite, a favoured but illegal fishing method. Some are said to be shot for sport by the fishing crews (de Silva, 1982).

Historical trends In the first half of this century, Hawksbill turtles were evidently hunted for their shell, as concern about their over-exploitation was expressed in 1927. This resulted in the imposition of a temporary ban on hunting and the subsequent introduction of closed season (de Silva, 1982).

Collection of turtle eggs has been practised for many years. The earliest records are from 1933, when licences were issued for the exclusive rights to collect eggs. Most eggs came from the three turtle islands, which now form the Turtle Island National Park. The history of exploitation is well documented by de Silva (1982 and 1984), and the levels of egg harvest are given in Table 116. Until the end of 1972, all the eggs collected were sold for human consumption, with the exception of those used in the hatcheries (Table 121). These averaged 14% of the total harvest between 1966 and 1971 (de Silva, 1984). From 1973 onwards, nearly all the eggs have been taken to the hatcheries (de Silva, 1982). Linear repression analysis of the

logarithmically transformed egg collection data (Table 116) showed that from 1965 until 1985 the egg yield declined by an average of 3.4% a year ($r = 0.737$, 19 d.f.).

Domestic trade - The main centre for trade in turtle eggs is Sandakan, where there is said to be an "insatiable" demand (de Silva, 1984). Since the closure of the Turtle Islands to turtle collectors in 1972, the demand has largely been supplied by eggs imported from islands under Philippine sovereignty. The price of eggs in Sandakan is shown in Table 118. It can be seen that there was a marked jump in the price in 1972 when the collection of eggs in the Turtle Islands was prohibited. Eggs are also sold in Kota Belud, where they fluctuate in price from US$0.15 in the season to US$0.25 in the off-season. The coastal people around Kota Belud also sell some turtle meat locally, and barter the carapace, plastron and flippers with Filipino traders (de Silva, 1984). There are small quantities of stuffed turtles and turtle shell sold in Kota Kinabalu, Tawau and Sandakan, most of which have been smuggled in from the Philippines (de Silva, 1984).

Table 118. The price of Turtle eggs in Sandakan (Malaysian cents per egg, M$2 = US$1 approximately, de Silva, 1984).

1968	1969	1979	1971	1972	1977	1982
9	10	11	11	40	45	50

International trade Although there was some trade with itinerant traders, de Silva (1982) indicated that the commercial sector had not become involved in the export of turtle products from Sabah. Legislation prohibiting the import of turtle shell, skin, calipee and oil was introduced in 1971, since when it is said to have been effective (de Silva, 1982). Until 1977, Sabah reported imports, exports and re-exports of unworked tortoiseshell and turtle eggs in its Customs statistics. These are given in Tables 119 and 120. Table 119 indicates that Sabah appears to have featured as a major entrepot for international trade in tortoiseshell, but it is not known what species of chelonian were involved. Further information of the imports of tortoiseshell from Malaysia is given in the section for West Malaysia.

Trade in turtle eggs is permitted under local legislation, and the local demand is met by imports of eggs from the Philippines (de Silva, 1984, see above), in spite of the fact that this is in contravention of CITES. Table 120 also indicates that Sabah has been active in the international trade in turtle eggs, importing them mostly from the Philippines and exporting a few, mainly to Brunei.

LEGISLATION

Fauna Conservation Ordinance, 1963 (28 June 1963).

All Cheloniidae are partially protected. National and international trade in the species <u>C. mydas</u> and <u>E. imbricata</u> is regulated. The hunting of these species is permitted only under licence and the taking of eggs is controlled. Natives may collect eggs in specified areas without licences. Other areas may be designated as "Turtle farms", where exclusive rights to collect eggs are granted.

Table 119. International trade in raw tortoiseshell (kg) recorded in Customs statistics from Sabah, compiled by Wells (1979).

Source/Destination	1973	1974	1975	1976	1977
IMPORTS					
France	0	9	10	0	0
Philippines	3251	0	1077	2473	19596
EXPORTS					
Singapore	11784	2794	0	0	0
RE-EXPORTS Raw tortoiseshell					
Singapore	0	0	0	5500	45490

Table 120. International trade in turtle eggs recorded in Customs statistics from Sabah.

	1974	1975	1976	1977	1980	1981	1982	1983
IMPORTS								
Indonesia	12800	5000	0	0	0	0	0	0
Philippines	132200	113295	80800	0	700	35000	8000	0
Total imports	145000	118295	80800	0	700	35000	8000	0
EXPORTS								
Brunei	76000	18000	0	9920	0	540	0	36500
Sarawak	150	0	0	0	0	0	0	0
Total exports	76150	18000	0	9920	0	540	0	36500
RE-EXPORTS								
Brunei	0	0	2000	0	0	0	0	0

Fauna Conservation (Turtle Farms) Regulations, 1964 (26 June 1964).

Regulates the taking of eggs of:

C. mydas

E. imbricata

Regulates the calls for tenders for the collection of their eggs in turtle farms (Turtle farms, as defined by the Ordinance, are areas wherein exclusive rights may be granted for the collection of turtle eggs). The collection of turtle eggs from turtle farms, or from any area reserved for the collection of turtle eggs, is prohibited during the month of March. The chief game warden is empowered to suspend or cancel the right to collect turtle eggs in the event of any breach of the regulations.

Customs (Prohibition of Exports) (Amendment) Order 1971 (8 May 1971).

Export of *C. mydas* and *E. imbricata*, including shell, skin, calipee and oil, is prohibited.

Customs (Prohibition of Imports) (Amendment) Order 1971 (8 May 1971).
Import of C. mydas and E. imbricata, including shell, skin, calipee and oil, is prohibited.

RANCHING

Turtle hatcheries have been run by National Parks staff in the Turtle Islands since 1966. Prior to 1972, eggs were purchased from the commercial collectors, but since then collection has been undertaken by the the staff. The numbers of hatchlings released and the hatching success are shown in Table 121.

Table 121. Numbers of hatchlings released from hatcheries in the Turtle Islands, and the percentage of eggs transplanted each year which this represents. Data for 1966 to 1978 are from de Silva (1982), for 1982 to 1985 from de Silva (in litt., 3 September 1986), and for 1986 from Chan Eng-Heng (in litt., 1 August 1988).

		Hatchlings released	% hatching
1966		15 005	71.1
1967		33 966	90.6
1968		96 951	70.5
1969		31 729	63.4
1970		49 181	65.2
1971		59 971	54.5
1972		232 906	57.8
1973		317 410	62.2
1974		304 889	82.7
1975		94 438	63.4
1976		114 665	54.7
1977		205 591	65.9
1978		235 648	73.1
1982		238 334	81.0
1983		173 774	74.5
1984	C. mydas	200 220	80.7
	E. imbricata	35 392	78.8
1985	C. mydas	160 896	77.1
	E. imbricata	27 783	79.5
1986	C. mydas	171 506	80.1
	E. imbricata	21 082	81.1

MALAYSIA: SARAWAK

POPULATION: Chelonia mydas

Nesting sites Almost all nesting takes place on the three "Turtle Islands" - Talang Talang Besar, Talang Talang Kecil and Satang Besar - in the South China Sea a few km off the coast of western Sarawak (Harrisson, 1969; de Silva, 1982). There is reportedly some nesting (density unknown) on the mainland at Tanjong Similajan north of Bintulu, and between Sematan and Sungai Semunsan.

Nesting numbers Some relatively detailed information is available on turtle nesting numbers and egg yield, obtained during the long history of intensive egg exploitation on the turtle islands. No data are available on nesting outside these islands, but numbers are likely to be insignificant in comparison. Over the six-year period 1980-1985, the egg production figures indicate an annual mean of 2170 nests (assuming clutch size of 100) and 723 females (if each lay three clutches).

Trends in nesting numbers The data presented in Table 122 show a distinct long-term decline in the number of nests laid and the number of eggs harvested. A particularly steep decline appears to have occurred during or soon after World War II, with further declines from 1960 onward and after 1970. The present nesting effort is around 20% of the post-war level, and only some 10% of the reported pre-war level.

Nesting season Some level of nesting persists almost throughout the year on the Sarawak "turtle islands", but nesting is most concentrated in June-August. Egg production is lowest during the north-east monsoon, which strongly affects the islands, and highest outside the monsoon (Hendrickson, 1958).

Foraging sites No information is available on preferred feeding grounds; no foraging areas appear to exist in the vicinity of the nesting islands (Hendrickson, 1958).

Migration Little information is available. Although Sarawak C. mydas appear to leave the nesting area after breeding, their destination is unknown. One report, which is unconfirmed, concerns a female tagged in 1952 being seen in the Natuna Islands, in the South China Sea about 330 km north-east of Sarawak (Hendrickson, 1958). The single confirmed record (Harrisson, 1960) is of a female recovered in Sabah.

POPULATION: Eretmochelys imbricata

Nesting sites Known E. imbricata nesting is restricted to the same three "turtle islands" used by C. mydas, namely, Talang Talang Besar, Talang Talang Kecil and Satang Besar, in the South China Sea off the coast of western Sarawak.

Nesting numbers No precise estimates are available, but on present information, numbers appear to be very low indeed (Harrisson, 1969; de Silva, 1982) and of little regional significance.

Trends in nesting numbers No direct information, although the species seems likely to have shared in the long-term decline in nesting numbers on the turtle islands (see C. mydas).

Nesting season Nesting appears to take place mainly in the early months of the year (Harrisson, 1969).

EXPLOITATION

Commodity There is a long tradition of eating turtle eggs but, as in the rest of Malaysia, turtle meat is not generally consumed. This is normally attributed to the Muslim beliefs of the majority of the population, although Hendrickson (1958) has questioned the theological basis of this.

Table 122. Reported egg production, turtle nestings, the numbers of eggs removed for hatchery programmes and the hatching success rate achieved on Talang Talang Besar, Talang Talang Kecil and Satang Besar, compiled from data in Banks (1936), Harrisson (1962), de Silva (1982), Leh (1985a, 1985b) and Proud (in litt., 1986). * Data for 1946 and 1947 are not complete.

	Egg production	Turtle nests	Eggs transplanted	% hatching
1927	2 119 912			
1928	2 330 228			
1932	2 252 866			
1933	1 468 904	13 531		
1934	3 152 521	29 218		
1935	924 896	-		
1936	3 039 237	30 000		
1946 *	929 123			
1947 *	708 035			
1948	1 767 078	17 000		
1949	793 166	7 195	0	
1950	2 357 674	20 000+	-	
1951	1 424 721	12 998	31 363	
1952	1 537 498	14 190	20 008	
1953	2 065 898	19 475	63 861	
1954	1 121 890	10 756	18 374	
1955	1 581 014	15 074	32 787	
1956	683 409	6 604	6 848	
1957	1 399 916	13 398	11 930	
1958	633 085	5 942	6 668	
1959	1 327 689	12 683	-	
1960	519 067	4 966	15 602	
1961	1 221 722	10 771	31 393	
1962	545 165	5 218	14 813	
1963	518 865	4 929	0	
1964	289 691	2 770	8 079	
1965	419 066	4 047	8 465	
1966	98 843	960	1 554	
1967	478 622	4 670	1 203	
1968	200 731	1 961	707	
1969	516 581	4 978	2 252	
1970	296 151	2 598	2 227	69.7
1971	194 289	1 918	180	70.6
1972	265 525	2 601	992	53.3
1973	323 734	3 155	8 535	93.8
1974	204 507	2 043	1 191	69.9
1975	203 140	2 009	991	85.5
1976	299 398	2 945	13 159	96.0
1977	159 156	1 567	13 134	90.3
1978	253 518	2 487	18 003	82.6
1979	211 472	2 062	18 100	91.4
1980	152 599		43 000	47.1
1981	225 927		43 000	56.7
1982	266 740	2 669	76 584	67.8
1983	208 743		110 071	75.0
1984	309 800	3 148	68 713	60.7
1985	138 741		32 570	63.1

Hunting intensity Almost all the turtles nest on three Turtle Islands (see above) and all the eggs laid are collected either for sale or for replanting into a hatchery. The numbers of eggs laid are given in Table 122, together with the numbers of eggs transplanted. Prior to 1978, the harvest amounted to between 100% and 91% of the total production (de Silva, 1982) but, from 1982 onwards, it was decided to increase the number of eggs saved to over 50% (Leh, 1985a). This goal was only achieved in 1983 (Table 122). A few turtles nest on mainland beaches, where eggs are said to be "randomly collected" (de Silva, 1982). So far as is known, the harvest of adult turtles is minimal.

Hunting methods All eggs from the Turtle Islands are collected under a Government monopoly, controlled by the Turtle Board, which was set up in the 1950s. The revenue from the sale of eggs is used to fund the hatchery programme and all turtle research.

Historical trends The first reliable statistics of egg collection are from 1927 (Table 122), and there are only scanty indications of the harvest before that date. The practice of collecting eggs on the Turtle Islands is ancient, and eggs were probably used as a barter item with China in the 16th century (Leh, 1985b). It has been suggested that the presence of numerous pirates in earlier years may have prevented the systematic and prolonged collection of eggs. Pirates were effectively controlled in the mid-19th century by Rajah Brooke, although when he visited Talang Talang in 1839 he reported that eggs were being collected on an organised basis and that "five or six thousand eggs are collected every morning". From this, Harrisson (1962) concluded that egg collection did pre-date the termination of piracy. Turtle egg collection continued through to the 20th century, but there are no good indications of the levels. Harrisson (1962) inferred that the harvest might have been higher because in 1842, 40 men were employed to collect eggs, whereas around 1960 this had fallen to 12-15. There is also some evidence of egg collection on mainland beaches in 1847. Customs data indicate that Turtle eggs were exported from Sarawak at the turn of the century, and that the peak year was in 1905, when 1 172 000 eggs were exported. Harrisson (1962) pointed out that a higher proportion of the eggs were exported at that time than in 1947, but it is not known whether this represents a higher total egg production or a lower domestic demand.

Even if the absolute levels of harvest cannot be determined, it is of interest to investigate the intensity of the harvest, which since 1930 appears to have been in the region of 100%. Banks (1936) reported that "as a rule, no eggs whatever are left to hatch, though a month's truce has occasionally been declared on one island". As collecting practices were more or less the same in the 19th century, it is tempting to assume that the harvest was also nearly 100% then. However there is some evidence of early conservation practices, as Hendrickson (1958) cites a report from 1842 indicating that, in spite of their vigilance, the egg collectors missed some nests and purposely spared others. Considerable numbers were evidently allowed to hatch as the sand at times was said to be "literally covered with" hatchlings. It is possible that limited transport and lower human population levels restricted the market for eggs, and ensured that the harvest was moderated.

Whatever happened in the 19th century, it is clear that since 1946 the harvest, and presumably also the turtle population, has been declining at a rate of around 7% a year, largely in response to the continuing egg harvest.

The only period when significant levels of exploitation of the adult turtles has been reported was during the Japanese occupation in World War II, when 300-500 turtles are thought to have been killed by the Japanese for food (Harrisson, 1947).

Domestic trade With the exception of any export trade, all eggs collected on the turtle islands are sold in Sarawak. The total revenue from the egg sales from 1964 to 1978 varied between M$8013 and M$61958 a year. This indicates that the price per egg rose from about 9 cents in 1964 to 26 cents in 1978. The costs of running the Turtle Board and collecting the eggs must be set against this income, and over the 14 years the gross income of M$499 754 was balanced by an expenditure of M$463 647, an average annual profit of M$2579 (de Silva, 1982).

International trade At the beginning of this century, Sarawak used to export large quantities of turtle eggs. Harrisson (1962) quoted totals of 1 172 000 for 1905, 551 000 for 1926 and 213 000 for 1931, saying that the export since 1947 had been negligible, but that eggs had started to be imported. From 1973 to 1977, Sarawak reported imports and exports of turtle eggs and unworked tortoiseshell in its Customs statistics. These are given in Table 123 and confirm that imports of eggs, mainly from neighbouring Kalimantan, continues. Schulz (1987) reported that there was a very substantial export of eggs from the Indonesian islands off Kalimantan to Sarawak. Sarawak is not reported as having exported any significant quantity of tortoiseshell, although relatively high levels of imports are recorded. There is no indication that these refer to the shell of marine turtles. Other aspects of the international trade of Malaysia are discussed in the section on West Malaysia.

RANCHING

A hatchery programme has been operated on each of the three Turtle Islands since the 1950s. Eggs are collected when they are laid, and a proportion are reburied in hatcheries. The numbers buried and the resulting hatching percentages are shown in Table 122. Since 1970, the hatching success rate has varied from 47% to 96%, with an overall mean of 70.0% (Leh, 1985b). Hatching success rates in the region of 70% are reported from May to October, although at other times of the year the success is said to be only about 20%. All the money for the hatchery and the research programme normally derives from the sale of eggs, although an additional grant of M$40 000 from state funds was made in 1982 (Leh, 1985a).

LEGISLATION

Turtle Trust Ordinance (1957), and Turtle Rules (1962).

Wildlife Protection Ordinance 1958 (1 January 1958), amended 22 February 1973.

The following species are listed as protected animals. They may not be hunted, killed or captured, except under licence. The animals, trophies thereof or their flesh may not be sold, possessed or exported:

C. mydas
E. imbricata
D. coriacea

Rights granted under the Turtle Trust Ordinance are exempted from these provisions.

Table 123. International trade in raw turtle products recorded in Customs statistics from Sarawak. Figures before 1977 compiled by Wells (1979).

Source/Destination	1973	1974	1975	1976	1977
IMPORTS					
(Raw tortoiseshell (kg))					
Indonesia (Borneo)	305	140	213	0	92
Singapore	5079	7114	10159	5076	0
Total imports	5384	7244	10372	5076	92
EXPORTS					
(Raw tortoiseshell (kg))					
Singapore	30	0	0	0	0
IMPORTS (Turtle eggs)					
Indonesia		380650	161635	334600	99800
Peninsular Malaya		0	0	0	175
Sabah		150	0	0	0
Total imports		380800	161635	334600	99975
EXPORTS (Turtle eggs)					
Brunei		0	4100	0	100

Source/Destination	1978	1979	1980	1981	1982	1983
IMPORTS						
(Raw tortoiseshell (kg))						
Indonesia (Borneo)						
Singapore						
Total imports						
EXPORTS						
(Raw tortoiseshell (kg))						
Singapore						
IMPORTS (Turtle eggs)						
Indonesia	367824	89480	95740	199890	189250	
Peninsular Malaya	0	0	0	0	0	
Sabah	0	0	0	0	0	
Total imports	367824	89480	95740	199890	189250	
EXPORTS (Turtle eggs)						
Brunei	0	0	1000	600	100	

WEST MALAYSIA

POPULATION: Chelonia mydas

Nesting sites Some nesting occurs on both west (Malacca Straits) and east (South China Sea) coasts, but is very sparse in the west.

Turtle nesting is rare on the mainland west coast. This is presumably in part because the coast has few suitable sand beaches, consisting mainly of mudflats and mangroves. Tanjong Kling (west of Melaka town) was used by C. mydas in 1975, but the beach is now unsuitable for turtles; the nearby islands Pulau Besar and P. Upeh may still be used. Similarly, Pangkor Island, Pulau Sembilan, and a few other islands off the Perak coast, also P. Pinang and P. Langkawi further north, now have only sporadic turtle nesting (Siow and Moll, 1982). The only substantial remaining mainland nesting site is Pasir Panjang Beach, near Pantai Remis, Perak, but this is subject to very heavy egg collection (Moll, 1987).

Turtles, including C. mydas, still nest at many sites on the east coast. Numbers are highest by far in Terengganu State, significant numbers also use Tioman island, off the Pahang coast. Pulau Perhentian and P. Redang (two islands off the coast of northern Terengganu) and the mainland along the Terengganu-Pahang border, are the main nest sites (Leong and Siow, 1984). In 1984, Pulau Perhentian and Pulau Redang accounted for 63% of the nests of C. mydas in the whole state (Abdul Rahman B. Kassim in litt., 4 October 1986).

Nesting numbers Very little direct information is available on nesting numbers, but egg collection data from licensed egg collectors allow an indirect approximation to be made. Although egg harvest is thought to be close to 100% throughout Malaysia (Chan Eng-Heng in litt, 8 October 1986), the collection figures are unlikely to be consistently reliable (for reasons outlined by Siow and Moll, 1982: 342). In Table 124, the egg yield data provided by Siow and Moll are given, with an estimate of annual female nesting numbers (assuming that each will lay, on average, three clutches of 100 eggs).

Table 125 includes recent more detailed information on harvest in Terengganu (Abdul Rahman B. Kassim in litt., 4 October 1986). Within Terengganu, egg yield data assembled by Siti and de Silva (1985, unpublished) are shown in Table 126. These cover some two-thirds of the total mainland coast, namely the 130 km between Chukai in the south and Rantau Abang.

The available data indicate that Terengganu is by far the most important area for C. mydas nesting, and within the state, the two northern islands, Pulau Perhentian and P. Redang hold around two-thirds of the total nesting (the remaining one-third being spread diffusely over much of the mainland coast). At Pantai Pasir Panjang on the west coast, Lee (1987) reported that only 30 turtles had nested between March and June 1987, compared with 270 in the same period in 1986. About 80% of these were thought to be C. mydas.

Trends in nesting numbers Siow and Moll (1982) compared results of a survey of egg yields on the east coast, performed in 1978, with results of a similar survey performed in 1956 (Hendrickson and Alfred, 1961). This comparison suggested a severe decline, of about 43%, in C. mydas egg yields. Siow and Moll discussed the extent to which differing methodologies may have produced these results, but concluded that the indicated severe

Table 124. Estimated annual yield of C. mydas eggs on the east coast of West Malaysia (based on 1978 data, after Siow and Moll, 1982), with extrapolation of possible annual nesting numbers.

	Egg harvest	Nesting females (Extrapolated)
Kelantan	400	2
Terengganu	298 000	1000
Pahang	91 000	300
Johor	12 000	40
Total	401 400	1342

Table 125. Number of C. mydas nests (Chan et al., 1988) and eggs harvested in Terengganu, based on returns from licensed egg collectors (Abdul Rahman B. Kassim in litt., 4 October 1986) with extrapolation of possible number of females.

	Nests	Eggs Collected	Nesting Females (Extrapolated)
1984	4292	370 134	1430
1985	1169	107 135	390
1986	4492		1497

Table 126. Numbers of C. mydas eggs collected and nests laid in Terengganu State between Chukai and Rantau Abang, obtained mostly from interviews with egg collectors (Siti and de Silva, 1985, unpublished).

	Approx Egg Harvest	Approx Nests laid	Nesting females (extrapolated)
1979	21 000	170	57
1980	18 000	155	52
1981	30 000	300	100
1982	78 000	760	253
1983	45 000	950	280
1984	105 000	1340	447

decline "is mostly real". However, Chan Eng-Heng (in litt., 1 August 1988) highlighted the dangers of relying on the single-year estimate for 1956 for basing trends on. On the other hand, reported egg yields on beaches between Chukai and Rantau Abang in Terengganu (Siti and de Silva, 1985) indicated a gradual five-fold increase between 1979 and 1984. Because of problems in

interpreting yield data from licensed egg collectors it is difficult to discern trends with any confidence. On the west coast, Moll (1987) reported that disturbance, trawling and persecution had eliminated all but one nesting site. Lee (1987) voiced fears that the egg collection was rapidly depleting the colony at Pantai Pasir Panjang.

Nesting season On the mainland east coast C. mydas nests between January and October, with a peak in May-July; on the islands the season extends from March to December, with a peak in August (Leong and Siow, 1984).

Foraging sites No information; no important feeding grounds appear to be known in West Malaysian waters.

POPULATION: Eretmochelys imbricata

Nesting sites Relatively few E. imbricata nest in West Malaysia; significant numbers occur only on Pulau Redang, at Tanjung Galiga on the mainland, both in Terengganu, and on certain islands, including Tioman, off the Pahang-Johor border (Leong and Siow, 1984; Siow and Moll, 1982). A very small number arrive regularly on beaches north of Melaka (Scriven in litt., 5 November 1986). Lee (1987) reported that two species of turtle nested at Pantai Pasir Panjang on the west coast, one of which, known locally as "penyu karah", he thought was probably E. imbricata.

Nesting numbers In the absence of appropriate surveys, nesting numbers can be gauged primarily by yield data from licensed egg collectors.

Trends in nesting numbers No reliable data on long-term nesting trends are available, although Siow and Moll (1982) reported a decline in overall sea turtle egg production of around 43% between 1956 and 1978.

Nesting season The season extends from January to September, with a peak in May, on Pulau Redang, and from February to June, with a peak in April, at Tanjing Geliga.

Foraging sites No detailed information. The species occurs in small numbers around the coast of West Malaysia, including the Malacca Straits (where two were recently documented being released from fishermens nets at Port Dickson; Scriven, 1986).

Table 127. Estimated annual yield of E. imbricata eggs on the east coast of West Malaysia (based on 1978 data, after Siow and Moll, 1982), with extrapolation of possible annual nesting numbers. The Pahang figure mostly reflects nesting on Tioman.

	Egg harvest	Nesting females (Extrapolated)
Kelantan	-	-
Terengganu	10 700	35
Pahang	5 400	20
Johor	2 500	10
Total	18 600	60

Table 128 shows more detailed recent information for Terengganu State (Abdul Rahman B. Kassim, in litt., 4 October 1986).

Table 128. Number of E. imbricata nests in Terengganu (Abdul Rahman B. Kassim in litt., 4 October 1986), with extrapolation of possible number of females.

	No of nests	No of females (Extrapolated)
1984	151	50
1985	200	65
1986 (Jan-Aug)	199	65

EXPLOITATION

Commodity Turtle eggs are a delicacy in Malaysia, and have traditionally been harvested by the coastal people. They are sometimes regarded as aphrodisiac. Most Malays are Muslims, and consider turtles haram and refrain from eating the meat (Siow and Moll, 1982). The Chinese constitute the second largest ethnic group in Malaysia (37%) but, although they eat freshwater turtles, they are said not to eat marine turtles (Moll, 1976).

Hunting intensity The harvesting of eggs is very extensive and is said to be in the region of 100%. Estimated harvests for C. mydas and E. imbricata in 1978 are given in Tables 124 and 127 respectively. More recent harvests for the state of Terengganu alone are given in Tables 125 and 128. The egg harvest for C. mydas in the southern part of the state was estimated by Siti and de Silva (1985, unpublished) and figures for 1984 (Table 126) indicate that this region produced 28% of the harvest for the whole state (Table 125), 67% of the harvest coming from two islands in the north, Pulau Perhentian and Pulau Redang (Abdul Rahman B. Kassim in litt., 4 October 1986). At Pasir Panjang Beach, on the west coast the egg collection is completely unregulated and virtually all of the eggs laid are collected (Lee, 1987; Moll, 1987).

Hunting methods Most of the egg collection (in theory, all) is carried out under licence. The rights to collect eggs on different beaches are put out to tender by the Government and are sold to the highest bidder. No deliberate capture of adult turtles is reported, but some are taken accidentally in trawls and other fishing gear. The fish catch in Malaysia increased from 113 kt in 1956 to 565 kt in 1978, due partially to increased fishing intensity. Prawn trawling on the west coast of the Peninsula is thought to be a serious threat to the turtles (Siow and Moll, 1982). Chan et al. (1988) investigated the accidental capture of turtles, and found that each trawl caught an average of 0.54 C. mydas in 1984 and 0.9 in 1985. Extrapolating from the number of trawlers, this led to an average annual incidental kill of 245. Drift nets were estimated to take a further 100 C. mydas. There was said to be no accidental capture of E. imbricata. Chan et al. (1988) pointed out that this represented an alarmingly high proportion of the nesting females.

Historical trends The trends in the number of eggs harvested have been discussed under "trends in nesting numbers". It appears that between 1956

and 1978 there was a substantial decline (43%) in the number of eggs harvested (Siow and Moll, 1982), although there is a strong annual fluctuation in the levels of harvest (see Tables 125 and 126).

Domestic trade - Turtle eggs are widely sold in markets, and usually fetch a premium price over hens eggs, often as much as five times (Siow and Moll, 1982). The price of eggs and the value of the harvest in 1978 are given in Table 129.

Table 129. The retail value of different species of turtle eggs in 1978, and the estimated value of the total harvest in the states on the east coast of Peninsular Malaysia. All values are in M$ (M$2.08 = US$1), from Leong and Siow (1984). * Callagur is a freshwater or estuarine turtle.

Species	Price	Kelantan	Terengganu	Pahang	Johor
D. coriacea	0.50	-	147 000	45 000	-
C. mydas	0.33	200	149 000	45 000	6 000
L. olivacea	0.28	10 500	120 000	17 000	5 000
E. imbricata	0.25	-	5 350	2 700	1 250
Callagur sp.*	0.38	400	6 750	600	250
Total		11 100	428 100	65 450	12 500

Revenue from the egg collection licences accrues directly to the Government and in 1978 amounted to US$985 in Kelantan, US$96 322 in Terengganu, and US$1097 in Pahang (Siow and Moll, 1982). Earlier revenues from Terengganu State were detailed by Polunin (1975), and are shown in Table 130. The turtle egg industry was estimated to employ a total of 110 people in 1978, including those involved in collecting, transport and marketing. Turtles also constitute a major tourist attraction in Malaysia, and the beach of Rantau Abang is estimated to attract 50 000 visitors annually, who come to watch the turtles (mostly D. coriacea) laying their eggs. This generates concomitant local income from such sources as cafes and curio shops (Siow and Moll, 1982).

International trade Until 1977, Peninsular Malaysia reported imports and exports of unworked tortoiseshell and imports of turtle eggs in its Customs statistics. These are given in Table 131. Peninsular Malaysia appears to have been a net exporter of tortoiseshell in all years except 1977, when imports exceeded exports by a large margin. It is not known whether this represents sea turtle shell or the shell of freshwater turtles. Given the extensive harvest of freshwater turtles for food in Malaysia, and the large resident Chinese population, it is possible that some, if not most, of this shell may have been freshwater turtle shell for medicinal purposes. Other countries also report imports of tortoiseshell from Malaysia in their Customs statistics, and these figures appear in Table 132. The shell imported by Japan was recorded as "bekko" and can therefore be assumed to be of E. imbricata. The Republic of Korea is known to be a major importer of sea turtle shell and exporter of manufactured turtle shell products (Canin and Luxmoore, 1985). It is therefore likely that much of the shell imported by Korea in 1983 and 1984 was of sea turtles.

Table 130. Revenue from egg-collection rights in Terengganu State from the Department of Fisheries (Polunin, 1975).

Year	Revenue (M$)
1961	75 823
1963	81 233
1964	75 746
1965	74 864
1966	58 689
1967	64 649
1968	67 098
1969	81 211
1970	88 610
1971	79 845
1972	95 000
1973	120 263
1974	134 430

There appears to have been a small amount of international trade in turtle eggs (Table 131). The largest reported import was in 1977, but it is not known where the eggs originated. The imports are insignificant compared with the domestic harvest.

CITES Reports indicate insignificant amounts of trade in sea turtle products of Malaysian origin. With the exception of 97 handbags in 1983, all were reported as imports to the USA (Table 133).

LEGISLATION

Turtle protection legislation in Peninsular Malaysia has been enacted separately in each state. In 1975, the Fisheries Department initiated attempts to streamline the regulations throughout the country and to transfer authority to itself at the federal level. This necessitated all the states passing enacting legislation (Siow and Moll, 1982), but it is not known how far this process has progressed.

Pahang: Fisheries Enactment, 1937, Fisheries Rules, 1938 (cited in Siow and Moll, 1982).
The capture, killing, injuring, possession or sale of turtles is forbidden without authorisation. No person shall prevent or hinder turtles from laying eggs.

Kelantan: Turtles and Turtles' Eggs Enactment, 1932, Amended by Enactment No. 8, 1935 (cited in Siow and Moll, 1982).
Prevents the capture and killing of turtles.

Terengganu: Turtle Enactment, 1951 (cited in Siow and Moll, 1982).
Prohibits the killing of turtles and controls the collection of eggs.

Table 131. International trade in raw turtle products recorded in Customs statistics from Peninsular Malaysia, compiled by Wells (1979).

Source/Destination	1973	1974	1975	1976	1977
IMPORTS Raw Tortoiseshell (kg)					
F.R. Germany	0	0	0	0	213
Indonesia (Sumatra)	335	0	30	0	0
Sarawak	0	100	0	0	0
Singapore	112	0	0	1563	10159
Total imports	447	100	30	1563	10372
EXPORTS Raw tortoiseshell (kg)					
Hong Kong	0	0	1818	7253	3515
Korea Rep.	0	0	0	0	3333
Singapore	16355	102	0	0	2031
Total exports	16355	102	1818	7253	8879
IMPORTS Turtle eggs					
Indonesia (Sumatra)		1300	0	0	0
Singapore		300	0	0	0
Others		0	0	0	15900
Total imports		1600	0	0	15900

Table 132. Imports of raw tortoiseshell from Malaysia reported in the Customs statistics of importing countries. All weights in kg. * Japan's imports were all recorded as "bekko". 0 = zero imports recorded. - = Import statistics not available for these years.

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
H. Kong	0	0	3815	4161	1750	0	0	0	0	0	0
Japan *	0	0	0	45	0	0	0	0	196	349	74
Korea	0	300	0	0	600	500	0	0	0	1000	1500
S'pore	5792	263	20	3946	6953	-	-	-	-	-	-
Taiwan	22	1900	0	0	0	0	-	-	-	-	-

RANCHING/HATCHERIES

Several hatcheries have been set up to purchase eggs from the egg collectors and rebury them in protected areas. The first to be established was at Rantau Abang (Terengganu), in 1961, which deals almost exclusively with D. coriacea. Another hatchery at Kg. Mangkok (Terengganu) is principally for L. olivacea and Callagur, but Chendor hatchery, in Pahang, and Dalam Ru, in Kelantan, are mainly for C. mydas, although the latter also has some L. olivacea. The numbers of hatchlings released and the hatching percentages are given in Table 134.

Table 133. All trade in C. mydas, E. imbricata or unspecified sea turtle products involving Malaysia recorded in CITES Annual Reports since 1976. The country underlined is the one which submitted the report.

Species	Commodity	Exporter	Importer	Origin	Purpose
1984					
C. mydas	20 Eggs	Malaysia	USA		
1983					
C. mydas	97 Handbags	Italy	Hong Kong	Malaysia	
Cheloniidae	11 Eggs	Malaysia	USA		Personal
E. imbricata	20 Eggs	Malaysia	USA		
1982					
Cheloniidae	5 Eggs	Malaysia	USA		Illegal
1981					
C. mydas	12 live	Malaysia	USA		Personal
1980					
Cheloniidae	1 case eggs	Malaysia	USA		Personal
1979					
Cheloniidae	10 Unspecified	Malaysia	USA		Commercial

Table 134. Numbers of hatchlings sea turtles of all species released and hatching percentages achieved at Dalam Ru and Chendor Hatcheries. * In 1978, Dalam Ru received all its hatchlings from Kg. Mangkok (Siow and Moll, 1982).

	Dalam Ru		Chendor	
	Released	% hatched	Released	% hatched
1964	1971	53.6		
1965	4558	50.3		
1966	4080	41.6		
1967	0	-		
1968	0	-		
1969	2395	19.5		
1970	5226	41.8		
1971	5237	46.8	3514	84.9
1972	2605	37.0	10619	75.9
1973	0	-	4341	70.7
1974	0	-	4511	90.1
1975	0	-	0	-
1976	0	-	13227	90.6
1977	0	-	0	-
1978	2447	-	8094	79.7
1979	1366	65.7		

A fifth hatchery was started, in 1979 on Pulau Perhentian (Terengganu), primarily for C. mydas (Siow and Moll, 1982). Abdul (in litt., 4 October 1986) gave details of the numbers of C. mydas and E. imbricata released from hatcheries in Terengganu state from 1980 to 1986 (Table 135). It is likely that many of these will have been at Pulau Perhentian.

Table 135. Numbers of C. mydas and E. imbricata released from hatcheries in Terengganu State (Abdul Rahman B. Kassim in litt., 4 October 1986).

	C mydas	E imbricata
1980	115	1960
1981	3137	946
1982	2136	2365
1984	5421	180
1985	2255	-
1986	3604	2608

POPULATION: Chelonia mydas

Nesting sites Turtles reportedly nest on the beaches of virtually all uninhabited islands throughout the Maldives archipelago, and on a few inhabited islands (M. Hassan Maniku in litt., 17 October 1986). Munch-Petersen (in litt., 24 September 1986) spent several years in the Maldives, visiting all atolls and some 400 islets; he found both species in large numbers throughout the archipelago, with nesting, by C. mydas at least, on numerous islands from the far north to the south. Questionnaire surveys reported by Frazier and Frazier (1987) indicated that the inhabitants of the northern atolls were slightly more familiar with Green Turtles than those in the south. Major documented nest sites include Thiladunmathi Atoll (Mulhadhoo Island); Baa Atoll (Kunfunadhoo, Maadhoo, Olhugiri and Kanufushi Islands, and formerly Dhunikolu, Fares, Maarikilu and Miriyandhoo Islands); Ari Atoll (Hukureulhi Island); Meemu Atoll (unknown island in the south-west); Thaa Atoll (Kanimeedhoo Island, formerly known for turtles); Laam Atoll (Gaadhoo Island). All other atolls are thought likely to have turtle islands (Frazier and Frazier, 1987).

Nesting numbers A questionnaire survey of turtle breeding and exploitation in the Maldives was organised in 1983-1984 by N.T. Hasen Didi and J. Frazier. Preliminary results suggest the presence of about 700 nests on four islands of Baa atoll, five nests on North Malé, three on South Malé, around 30 on Ari, and around 260 on five islands of Laam atoll (M. Hassan Maniku in litt., 17 October 1986; preliminary results of questionnaire survey by N.T. Hassen Didi and J. Frazier). The total estimated number of nests per year on inhabited islands was 1305 which, assuming three nests per season, represents 435 C. mydas. [n.b. at a later stage Frazier and Frazier (1987) stated that every nesting turtle was captured on some inhabited islands, and so it is unlikely under these circumstances that each would lay three nests.] However, uninhabited islands are both more numerous and more favoured by turtles, and they were not included in the survey. A "very rough" estimate of nesting C. mydas is therefore about 870-1300 a year (Frazier and Frazier, 1987).

Trends in nesting numbers The rise in turtle exploitation over the past two decades is thought to have had a marked adverse effect on turtle populations (Colton, 1977; Munch-Petersen, 1985). Didi (1983) cites the island of Mulhadu, in the extreme north of the archipelago, as representative of a trend toward declining turtle populations. According to his informants on Mulhadu, 50 years ago 150-200 turtles would come ashore nightly to nest, but now probably one or two nest nightly (preliminary results of questionnaire survey by N.T. Hasen Didi and J. Frazier). Didi (1983) reports that there were so many turtle tracks, criss-crossing one another, that the island egg-collectors missed many nests and these were able to hatch successfully (the inhabitants of Mulhadu used to sell eggs on other islands). These figures suggest that, whereas many thousands might have nested annually 50 years ago, annual numbers at present are likely to be a few hundred at best; no other site in the Maldives (for which information is available) approached the density at Mulhadu (preliminary results of questionnaire survey by N.T. Hasen Didi and J. Frazier). Similar anecdotal evidence exists for many islands on four other atolls; questionnaire responses showed that turtles were considered to have declined on 82% of the islands, stayed the same on 15% and increased on only 2%. Declines were reported more frequently in the north than in the south. These estimates led Frazier and Frazier (1987) to conclude that a massive decline in nesting numbers had occurred.

Nesting season Didi (1983) reports that nesting formerly occurred throughout the year on Mulhadu, with a peak at the start of the north-east monsoon (October-February). At Thiladunmathi, nesting occurs year round, with a peak starting in November, the beginning of the north-east monsoon; at Baa Atoll nesting is most active in December-January; and at Gaadhoo (Laam) the peak nesting is from June to December, although some nesting occurs in all months (Frazier and Frazier, 1987).

Foraging sites A large pasture of *Thalassia hemprichii* and *Syringodium isoetifolium* exists east of Thuladhoo (Baa) but is not an important feeding area. Other pastures exist on the eastern and southern sides of Laam Atoll and between Fonadhoo and Baraasilhoo, which are said to be favourite haunts of feeding turtles. Large marine pastures are rare in the Maldives, leading Frazier and Frazier (1987) to conclude that, although they may be able to support the current population of *C. mydas*, they would have been insufficient for the large population which is postulated to have existed formerly.

Migration There is no evidence from the very scant tagging studies of any migration of turtles in the Maldives. However, because of the lack of pasture Frazier and Frazier (1987) discussed the possibility that turtles nesting in the Maldives may feed elsewhere, such as the Gulf of Mannar.

POPULATION: *Eretmochelys imbricata*

Nesting sites *E. imbricata* nests were found on Kunfunadhoo (Baa Atoll) and Baros (North Male), with specimens seen in Baa, North Male, South Male, Laam and Vavu. Questionnaire responses indicated that the local inhabitants were familiar with this species throughout the archipelago, and Frazier and Frazier (1987) concluded that it probably nested on most uninhabited islands in all of the atolls.

Nesting numbers A questionnaire survey showed that the number of *E. imbricata* nests per inhabited island varied from 0 to 20 a year, with a total of 313 nests reported. Assuming that more nested on the uninhabited islands, and that each turtle nested three times a season, Frazier and Frazier (1987) considered it unlikely that there were more than 500 females nesting annually in the whole archipelago.

Trends in nesting numbers The results of a questionnaire survey showed that the respondents considered that *E. imbricata* had declined on 83% of the islands. Frazier and Frazier (1987) pointed out that the absence of detailed data made anything but the most rudimentary estimate of historic trends impossible. However they inferred from the scale of exploitation that a dramatic population reduction from former levels was likely.

Nesting season Nesting occurs throughout the year on Baa Atoll, but the main nesting season is said to be December. A nest was made in North Male on 17 November, and hatchlings emerged in South Male in February (Frazier and Frazier, 1987).

Foraging sites The rich coral reefs in the Maldives "must provide a vast and well stocked feeding area for *Eretmochelys*" (Frazier and Frazier, 1987).

Migration No information available. It seems possible, accepting that turtles are still widely encountered in the Maldives although nesting populations are said to be severely depleted, that a significant proportion

of the Maldive turtle population is composed of foraging (non-nesting) migrants.

EXPLOITATION

Commodity Both E. imbricata and C. mydas are hunted for meat and their eggs are collected. Traditionally C. mydas was rarely used for food and only its eggs were collected, while E. imbricata was hunted for shell (Munch-Petersen, 1985). Moslem beliefs formerly forbade the eating of turtle meat, but a religious leader in the 1950s refuted this on theological grounds, and thereafter the consumption of turtle meat became widespread, although some of the population are still reluctant to eat it (Frazier, 1980a; Frazier and Frazier, 1987). There is a major tourist trade for curios (bangles, combs, earrings, boxes etc.) and stuffed turtles, and Hawksbill shell is exported. N.F. Munch-Petersen (in litt., 24 September 1986) reported that some women avoided the meat, fearing that it caused foetal deformities. Turtle penis is sometimes considered to be an aphrodisiac. There is one report of turtle poisoning in the Maldives, from 1978 in one of the southern atolls. Some people eat C. mydas but reject E. imbricata, considering it to be poisonous; E. imbricata is eaten commonly in 27% of the islands, rarely in 37% and never in 35%. C. mydas is eaten commonly in 53% of the islands, rarely in 43% and never in only 6% (Frazier and Frazier, 1987).

Hunting intensity A questionnaire survey of turtle breeding and exploitation was carried out in the Maldives in 1983-1984 by N.T. Hasen Didi and J. Frazier. The results of this survey show tremendous variation, and may not be reliable, but they showed that the number of C. mydas caught per island per year varied from 0 to 180, giving an estimated annual harvest of 1566. The harvest was greatest in the northern atolls. E. imbricata catches varied from 0 to 500 a year on each island, with a total of 2800, evenly distributed between the north and south. One island, Gaadhoo, has a locally enforced ban on killing turtles, but on many inhabited islands it is likely that every nesting turtle is caught. Egg harvests are high and may approach 100% on several islands (Frazier and Frazier, 1987).

Hunting methods The majority of turtles are turned on the nesting beaches. Those caught at sea are either gaffed while resting or feeding, chased by boat in shallow water or caught by diving (Frazier, 1980a). Frazier and Frazier (1987) reported that some may be caught on hook and line and that many are caught accidentally in shark nets. Around 42% of the C. mydas and 35% of the E. imbricata were said to have been caught in the sea, while the others were caught on the islands (M. Hassan Maniku in litt., 6 November 1986).

Historical trends The Maldives have long been a source of Hawksbill shell, featuring in the trade routes of antiquity; by the 12th century they were already well known. N.F. Munch-Petersen (in litt., 24 September 1986) mentioned that before the formation of the Republic (1968), catching Hawksbills was a royal monopoly, which had the effect of limiting the catch somewhat. Until recently, the Moslem population did not eat turtle meat for religious reasons, eating only turtle eggs. In the 1950s, the religious ban was lifted and ever since then, the hunting of both E. imbricata and C. mydas has been increasing (Didi, 1983), aided by the introduction of motorised sea transport, which allowed regular access to all points of the archipelago (Munch-Petersen, 1985). The onset of organised tourism in 1972 introduced a new demand for stuffed turtles and other curios, and by 1977

the 15 000 tourists were estimated to be buying 2000 E. imbricata a year (Frazier, 1980a). According to Moutou (1985a), stuffed marine turtles or shells are on sale everywhere in the Maldives. New legislation to impose size restrictions on turtle capture in 1977 are not thought to have been notably effective (N.F. Munch-Petersen in litt., 24 September 1986). Frazier and Frazier (1987) confirmed that a large percentage of carapaces on sale to tourists were smaller than the minimum size limits.

Domestic trade Frazier (1980) tabulated prices of various commodities in 1976. Meat fetched US$0.5-1.0 a kg, oil US$0.76 a l, eggs US$0.02-0.04 each, stuffed Hawksbills US$11.45-20.36, and shell US$6.11 (C. mydas) to US$40.71 (E. imbricata) a kg. Eggs are commonly collected and sold, some being taken to Male. On Gaadho (Laam), the eggs are auctioned and the proceeds are put towards village needs, such as the school of the mosque (Frazier and Frazier, 1987).

International trade The Maldives has been one of the main sources of Hawksbill shell for the artisan carving industry in Sri Lanka, and has supplied a variety of other countries (Colton, 1977). In 1977, a law was passed banning the export of raw tortoiseshell, and allowing only worked material to be exported. This is reflected in the exports of tortoiseshell reported by the Ministry of Fisheries (Table 136) which fell sharply in 1978, and apparently ceased in 1980. However, Japanese Customs reports also provide an indication of the export of tortoiseshell from the Maldives to Japan, and these data are also shown in Table 136. No shell was imported prior to 1973, after which imports climbed to 1266 kg in 1978. In 1979 there was a sharp fall in the trade volume, possibly reflecting the effects of the new legislation; however, exports subsequently increased to record levels in 1985 and 1986, implying that some way had been found of circumventing the export controls. At one time, presumably in the early 1980s, shell was exported to Singapore (Kenchington, 1983).

Table 136. Weights and values of exports of raw tortoiseshell from the Maldives (data from the Ministry of Fisheries; and imports of raw bekko to Japan (from Japanese Customs reports).

Year	Exports from Maldives kg	Exports from Maldives Value (Rf)	Imports to Japan kg
1970	680	22 260	0
1971	270	7 998	0
1972	270	7 350	0
1973	1560	41 210	65
1974	5580	324 960	89
1975	4110	156 863	340
1976	6440	542 229	485
1977	6030	812 810	317
1978	1895	181 237	567
1979	4520	347 373	1266
1980	0	-	167
1981	0		355
1982			601
1983			406
1984			822
1985			2225
1986			1956

Most of the other exports of turtle material are believed to be in the form of curios purchased by tourists. Munch-Petersen (in litt., 24 September 1986) reported that there was an export market for small, formalin-preserved turtles, and correspondence with an aquarium fish dealer in the Maldives indicates that young turtles are occasionally exported, concealed in consignments of fish.

The Maldives is not a Party to CITES, and there are few records of trade in turtle products in the CITES Annual Reports. Since 1977, a total of 12 shells have been reported imported to the USA, two to F.R. Germany and one to the UK.

LEGISLATION

Laws relating to the catching of tortoises, turtles and lobsters, No. 24/78. (24 April 1978).

Catching of turtles in the Male Atoll is banned.
Catching E. imbricata of less than 2 ft (61 cm) and of other sea turtles of less than 2.5 ft (76 cm) is prohibited in any part of the Maldives.
The use of spearguns for fishing is prohibited.

A regulation of the Ministry of Forestry bans the sale or display for sale of turtles below the size limits specified in Bill 24/78, but this is said to be rarely enforced (Frazier and Frazier, 1987).

No. 31/79. The export of unworked shell of E. imbricata is prohibited.

POPULATION: Chelonia mydas

Nesting sites Bikar Atoll is regarded as the most important C. mydas nest site in the Marshalls (Pritchard, 1982b). Nesting has also been reported on Arno, Kwajalein and Ujelang, and most of the turtle nesting on Jemo, Erikub, Taka, Enewetok, Jaluit, Bikini and Taongi (Pritchard, 1982b), is likely to be by C. mydas.

Nesting numbers Very little information is available. Fosberg (1969, cited in Pritchard, 1982b) reported that well over 300 females came ashore on Bikar during the seven nights of 5-12 August; Pritchard infers from other information in Fosberg's paper that the figure cited ("over 300"), is likely to be a misprint for "over 30". This seems to be confirmed by the fact that Hendrickson (unpublished, cited by Pritchard, 1982b) recorded a comparable density; he counted tracks of 39 females made over six days. Hendrickson estimated that the Bikar breeding population included around 700 mature females in all (i.e. possibly some 230 annually), and concluded that the population was of "only small size, not constituting an exploitable wild resource of any significant magnitude" (cited by Pritchard, 1982b). Few data are available for other sites, but in no case do nesting numbers appear to approach those at Bikar, which is small in world terms. Fosberg (1969, cited by Pritchard, 1982b) observed tracks on Jemo corresponding to 22 turtles over several days in December 1951. Jemo was formerly regarded as a bird and turtle reserve, with harvesting being allowed on only one month in the year; on Erikub, different persons estimated 3-4 or 6-8 turtles may nest nightly (sources cited in Pritchard, 1982b).

Trends in nesting numbers Both Pritchard (1977) and Johannes (1987), referring to Micronesia in general, state that turtle populations appear to have declined, perhaps slowly and over several centuries (Pritchard, 1977); no detailed information relating specifically to the Marshall Islands is available.

Nesting seasons Nesting on Bikar appears to reach a peak in June-July (Pritchard, 1982b).

Foraging sites Little specific information is available, although informants of Pritchard (1982b) reported that Ebon is rich in resources generally, and is the best area for catching turtles in the water.

POPULATION: Eretmochelys imbricata

Whilst this species is said to be the second most abundant turtle in Micronesia generally, very little information is available for the Marshall Islands. Only one of 35 sets of tracks recorded by Hendrickson on Bikar was attributed to E. imbricata (cited by Pritchard, 1982b).

EXPLOITATION

Commodity Turtle eggs are collected on many of the islands, and C. mydas is caught for meat. There are a few references to the use of E. imbricata shell for ornaments (Johannes, 1986).

Hunting intensity There is no information on the current levels of harvest. Pritchard (1982b) reported that at Ebon Atoll, one of the main turtle fishing areas, two to four turtles are caught a night.

Hunting methods Nesting turtles are turned on several of the islands, and there is a net fishery at Ebon Atoll. The inhabitants of Erikub Atoll were said to tether female turtles to attract males, which could then be captured (Pritchard, 1982b). Johannes (1986) described some of the taboos and customs associated with collecting turtle eggs, most of which were taken on special trips to the uninhabited islands where most of the turtles nested.

Historical trends The original inhabitants had many traditions and taboos associated with the capture of turtles and the collection of their eggs, which had the effect of limiting the harvest. Many of the taboos have disappeared as a result of social developments (Johannes, 1986).

Domestic trade There is evidently some local trade in turtles, as Pritchard (1982b) cited a report of a boatload of turtles being landed on Kwajalein for sale to the workers at the missile range.

International trade International trade with the Trust Territory as a whole is discussed under "PALAU". Fijian Customs reports indicated the export of some worked tortoiseshell items to the Marshall Islands in 1974.

LEGISLATION

Until November 1986, the USA Endangered Species Act (q.v.) used to apply. However, the islands now have their own legislation, modelled on the Trust Territory code (see under PALAU). No further details are available.

POPULATION: Chelonia mydas

Nesting sites C. mydas nests on several beaches around Martinique, but is most numerous in the south-east (Dropsy, 1987); no nesting was reported during earlier surveys (Carr et al., 1982).

Nesting season Nesting occurs from May to November with a peak from August to September (Dropsy, 1987).

Foraging sites Green Turtles were the most common species around the island. Extensive reefs and sheltered waters along the southern two-thirds of the east coast provided important foraging habitat (Carr et al., 1982). Bacon (1981) reported the regular occurrence of foraging adults of the species. There were no reports of juveniles foraging.

Migration According to Carr et al. (1982), local people believed that the Green Turtles around Martinique migrated to Aves Island to nest. Carr et al. (1982) also reported the recovery around Martinique of tags from one Green Turtle that was tagged at Tortuguero, Costa Rica, and from three that were tagged at Aves Island. However, Pritchard (1980) cautioned that the turtles might have been illegally caught on Aves Island itself, the fishermen having concealed the true locality.

Nesting numbers An estimated 56-76 nests were made per year in 1985 and 1986 (Dropsy, 1987); this could represent some 20 females.

POPULATION: Eretmochelys imbricata

Nesting sites Carr et al. (1982) recorded nesting at Loup Garou, Macabou, Bay D'Anglais, Pointe des Salines and Ilet à Madame. Fretey (1984c) reported possible nesting at Sainte Philomene and Anse Couleuse.

Nesting numbers Together with the Leatherback, Hawksbills were the predominant nesting turtles (Carr et al., 1982), and nesting was said to be frequent (Bacon, 1981). Dropsy (1987) estimated that 245-375 nests a year are made; this could represent some 75-125 females.

Nesting season Nesting occurs from May to October with a peak from June to September (Dropsy, 1987).

Foraging sites Important foraging habitat was found along the southern two-thirds of the east coast (Carr et al., 1982), and foraging adults occurred frequently (Bacon (1981).

EXPLOITATION

Commodity The meat and eggs of both Green Turtles and Hawksbills were said to be consumed locally. Income was derived from the sale of shells, jewellery and stuffed turtles (Carr et al., 1982). Turtle meat is said to be prized because of its rarity and certain products (eggs, tail, shell) are still valued as aphrodisiacs (Dropsy, 1987).

Hunting intensity The level of exploitation was considered by Carr et al. (1982) to be higher in Martinique than anywhere else in the Lesser Antilles. Fisheries statistics showed annual catches of 20-40 tonnes (all species, whole turtle weights) for the period 1959-1976 (Carr et al.,

1982). The mean annual catch of turtles in 1985 and 1986 was said to be 437-529 for E. imbricata and 595-685 for C. mydas. The main fishing area for the former was the north-east and for the latter, the south-east. Only about ten of the 1000 fishermen in Martinique specialise in catching turtles, but it is estimated that some 7 km of turtle net are set (Dropsy, 1987).

Hunting methods Nesting turtles were said to be taken on the beach whenever they were found (Carr et al., 1982). A few families use large-mesh nets (10-40 cm) for catching sharks, rays and turtles but accidental capture of turtles in lobster nets are said to be "not rare". Some turtles are also caught by divers, especially unemployed youths. This activity goes on throughout the year, but net fishery is mainly carried out from July to January. Eggs are also collected opportunistically, but not in an organised fashion (Dropsy, 1987).

Historical trends FAO Fisheries statistics for the catch of "marine turtles not elsewhere specified" are given in Table 137. From 1971 to 1973, catches of less than 50 tonnes were recorded.

Table 137. Catches of "marine turtles, not elsewhere specified" (t) in Martinique, recorded in FAO Fisheries statistics.

1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
21	34	14	24	11	46	46	46	54	50	51

Domestic trade Carr et al. (1982) considered the tourist trade in shell, stuffed turtles, and jewellery to be 'monumental', and observed boxfuls of stuffed juvenile Hawksbills for sale in souvenir markets in Fort de France. Fretey (1984c) reported that turtle products were sold to tourists in great numbers. He said that some Hawksbill shell was worked locally by prisoners in the Fort de France prison. Live turtles are said to sell for F50-5000, depending on size, steak for F50-60 a kg, polished carapaces for F200-1500 and stuffed turtles for F400-2000. The laws forbidding the sale of turtle products for six months are openly flouted (Dropsy, 1987; Le Serrec, 1987).

International trade As an Overseas Department of France, Martinique is included in the EEC regulations and also under the French ratification of CITES (11 May 1978). France had placed reservations on C. mydas and E. imbricata but these were withdrawn on 1 January 1984. CITES Annual Reports for the period 1977-1985 recorded the import to the USA from Martinique of only one shell of C. mydas.

Fretey (1984c) reported figures obtained from the Prefecture showing the import, in 1979, of 89 kg (value, 6000 francs) of raw shell and 1214 kg (value, 98 000 francs) of polished shell. Imports of bekko from the French West Indies reported in Japanese Customs statistics are discussed in the section on Guadeloupe.

There are unconfirmed reports that companies from F.R. Germany have recently obtained stocks of tortoiseshell from Martinique or Guadeloupe (B. Luther in litt., 3 April 1987). Carr et al. (1982) reported that a shell dealer from Martinique was active in purchasing tortoiseshell for export from other Caribbean islands, especially Dominica. In 1980, several of the stuffed turtles on sale in tourist shops were said to have been imported from "Saint

Domingue" (Dominican Republic?), and frozen turtle meat was purchased from foreign fishing boats, especially Venezuelans (Dropsy, 1987). Export records from the Dominican Republic show the export to Martinique of 6332 kg of turtle between 1980 and 1983 (Ottenwalder, 1987b).

LEGISLATION

Arrêté of 5 December 1927 provided for the protection of turtle eggs.

Arrêté Préfectoral Martinique No.496/PMC, 19 March 1983.
It is forbidden to take, sell, purchase or consume:

Any turtle eggs
Any D. coriacea.
Any C. mydas or E. imbricata between 15 April and 15 October or of less than 60 cm in length outside this period.

POPULATION: Chelonia mydas

Nesting sites Although the species is present along the entire coast of Mauritania, confirmed nesting sites are rather few. Known sites include Cap d'Arguin (on the north coast of the Banc d'Arguin), the north coast of the Iwick (Iouik) peninsula, and (according to Imraguen fishermen) along the south coast of Cap Timiris (Maigret, 1983). Local fishermen report that all five of the region's sea turtles nest along the southern half of Mauritania's remote and sparsely-inhabited coast, between Cap Timiris, Nouakchott, and the border with Senegal (Maigret, 1983).

Nesting numbers No detailed information available; data presented by Maigret (1983, Table 5, Fig. 1) do not suggest that a large nesting population is present.

Nesting season Nesting on the Cap d'Arguin has been recorded at the end of July, and Imraguen fishermen report mating in June-July in the southern sector of the Banc d'Arguin (Maigret, 1978).

Foraging sites Mauritania appears to be more important in providing foraging habitat for C. mydas than nesting sites. The species occurs along the entire coast of Mauritania, but is particularly abundant in the Banc d'Arguin, with its extensive shallows and beds of marine vegetation. Juveniles, some 30-40 cm in carapace length, are common around the Pointe des Coquilles, in the Baie du Lévrier, and around Cap Tafarit (Maigret, 1978).

POPULATION: Eretmochelys imbricata

No confirmed nest sites are known, although some nesting may well occur, much of the coast being remote and unsurveyed. The species is relatively frequent off shore along the coast between the Senegal border and Cap Timiris, where (in 1975-1977) each fishing boat would net 2-3 juvenile E. imbricata a season, rarely over 40 cm in length, but it is apparently rare toward the north, where the Imraguen catch practically none (Maigret, 1983). Local fishermen report that all turtle species occurring off shore between Senegal and Cap Timiris also nest there.

EXPLOITATION

Commodity Green Turtles are frequently captured in Mauritania, and constitute 85% of the turtles caught on the Banc d'Arguin. Turtles are mainly used for meat, but there is also said to be a tourist trade in turtle products (Verschuren, 1985). Most of the shells are C. mydas and C. caretta. E. imbricata is very seldom caught in the north of the country, but features as an incidental catch in the south (Maigret, 1983).

Hunting intensity There are no indications of the current levels of harvest, but C. mydas is said to form an important source of protein for the coastal people. Visiting Breton crayfish boats were said to capture 2-3 Hawksbills a season in the south of the country (Maigret, 1983). Verschuren (1985) claimed that the trade demand for turtles was resulting in "intense" hunting pressure, although this was questioned by Maigret (in litt., 8 September 1987) who said that since 1975 the crayfish are only caught by artisanal boats from Nouakchott and from St Louis in Senegal.

Hunting methods Turtles are captured by the Imraguen fishermen in nets or by harpoon, after which they are often kept in coastal lagoons until they are ready for slaughter (Maigret, 1983).

Historical trends The Imraguen fishermen have fished for turtles on a subsistence basis since time immemorial (Verschuren, 1985). There are fears that the catch of turtles will have increased as a result of the Sahelian drought, which has had the effect of increasing the demand for turtle meat and raising its price (Maigret, 1983).

Domestic trade Traders are said to sell turtles to tourists in Nouadhibou, where Verschuren (1985) implied that there was a strong demand. Maigret (in litt., 8 September 1987) reported that the demand in Nouakchott is not strong, although it increases markedly when parties of German tourists arrive, as was observed from 1980 to 1982. This trade probably amounts to 100-150 shells a year.

International trade Mauritania is not a Party to CITES, and the only indication of trade in the CITES Annual Reports was of a single shipment of C. mydas to the USA for scientific purposes. The waters off Mauritania are frequently visited by foreign fishing vessels, and Verschuren (1985) implied that turtles caught there were sold in Dakar, Senegal. The most significant international movement of turtle shells is probably with the returning tourists.

LEGISLATION

Hunting and Wildlife Protection Act, 15 January 1975.
The hunting of all wild animals requires a licence. All trade in game meat is prohibited. [It is not clear whether the provisions of this Act apply to turtles].

MAURITIUS: RODRIGUES

Sea turtles no longer nest in significant numbers on Mauritius itself (Hughes, 1982), although Thompson (not seen, cited by Bonnet, 1986) reported a nest in 1977 and that he had been informed of nesting on Ile Plate, off north-east Mauritius. Nesting was last recorded on Rodrigues in the 1950s; C. mydas had formerly been abundant but as a nesting species has disappeared within living memory (Gade, 1985). The size of former nesting populations on Mauritius and Rodrigues is uncertain. Early reports, reviewed by Parsons (1962) and Bonnet (1984 and 1986), indicate that very large numbers once nested and foraged around the islands, but that numbers were already declining in the Mascarenes, and around Mauritius in particular, by the end of the 18th century, if not earlier. This decline is attributed to over-exploitation by mariners and the expanding colonial population. Whilst nesting has ceased on Mauritius and Rodrigues, foraging C. mydas still occur; six females tagged on Tromelin (see REUNION) have been recovered in Mauritian waters (Le Gall and Hughes, 1987). No information is available for Agalega. Appreciable nesting occurs only in the St Brandon group (Cargados Carajos). The extent of past nesting by E. imbricata, if any, is not known.

ST BRANDON SHOALS (CARGADOS CARAJOS)

POPULATION: Chelonia mydas

Nesting sites Hughes (1976b) reported signs of turtle nesting on 13 out of 21 islets visited between 13 November and 8 December 1971; three of the islets lacked beaches suitable for turtle nesting.

Nesting numbers Hughes's 1971 observations are summarised in Table 138.

Hughes (1976b: 184) suggested that the signs of nesting he observed were made by about 60 turtles, but also noted that the 1971-1972 nesting season was late and involved rather low numbers of turtles in the South-west Indian Ocean generally. Hughes (1974) estimated the annual nesting population as 200-600, and Hughes (1976a) as around 300.

Trends in nesting numbers According to Hughes (1976b), with the exception of North Island and possibly Big South Island there were fewer turtles nesting in the early 1970s than in former times; numbers may have been recovering on Pearl and Frigate after excessive exploitation by guano workers, who had abandoned the islands some years previously. Hughes was informed by local fishermen who had been in the islands for 29 years that turtle numbers in the area had declined considerably; they recalled having once seen fleets of hundreds of turtles, but no such numbers had been seen since the mid-1950s. This report presumably refers to foraging populations as well as nesting turtles. Hughes's (1976b) analysis of the harvest (see below) showed that the populations were probably declining slowly, but he cautioned that "the figures available do not justify any alarmist recommendations and prophesies of rapid declines".

Nesting season Most nesting occurs in the austral summer, particularly in November-February (Hughes, 1976b).

Table 138. Nesting sites, track numbers observed in the St Brandon shoals, 13 Nov-3 Dec 1971, with comments on nesting; data from Hughes (1976b)

Island	Number of tracks	Comments
Albatross	some old tracks	nesting formerly occurred, now very rare
North Island	100+	a little-visited reserve, dense nesting
Puits à Eau	5+	probably formerly dense nesting, but heavily exploited
Sirene	25	many old vegetated craters thus probably once dense nesting
Pearl	56	probably recovering from past exploitation by guano workers
Frigate	50 ?	assumed similar to Pearl
Tortue	15	
Coco	4	large human population, turtles probably almost extirpated
East Dagone	19	
West Dagone	14	
Long Island	26	
Little Capitaine	6	
Big South Island	51	
Point de Requin	10	
Total:	375	

Foraging sites Suitable feeding habitat, including algae and seagrass pastures, is abundant in the group and the area has the potential to support a substantial C. mydas population (Hughes, 1976b).

POPULATION: Eretmochelys imbricata

Hughes (1976b) reported that the species was once common throughout the St Brandon group and Mauritius, but was becoming rare by the 1970s. He found no traces of nesting by the species, but saw two juveniles and one sub-adult in the reef lagoon.

THREATS

Over-exploitation appears to be the principal threat to turtle populations in the St Brandon group, although the nesting islets are subject to occasional cyclonic storms which are likely to affect nesting beaches to some extent.

EXPLOITATION

Commodity The meat and eggs of C. mydas are eaten, but E. imbricata is considered poisonous, and it is illegal to sell it. A very small quantity of Hawksbill shell was said to be taken for export (Frazier, 1980a). Meat

and eggs were once consumed on Rodrigues and tortoiseshell and fat were exported (Gade, 1985).

Hunting intensity Turtle fishing is almost confined to the St Brandon archipelago. Most of the turtles caught are shipped to Mauritius, and recent catches are given in Table 139. Local consumption of turtles is said to average 30 C. mydas a year (Frazier, 1980a). C. mydas is still occasionally caught in fishing nets at Rodrigues (Gade, 1985), and E. imbricata may be caught at Rodrigues and Agalega. A small number of C. mydas are evidently caught around Mauritius, as fishermen have reported tag returns (Bonnet, 1986).

Hunting methods The main method of capture is by harpooning breeding animals, using a harpoon with a detachable, unbarbed head. Females are also caught on the beaches, and spear guns and skin diving equipment are increasingly being used. The use of outboard motors has greatly increased the success of hunting at sea (Hughes, 1976b).

Historical trends The first settlements were established on St Brandon in the early 19th century, and local turtle exploitation started at about this time. Regular transport to Mauritius was not established until the early 20th century, and this initiated an organised turtle fishery. The Mauritius Fishing Development Company stared operations in 1927, and the catches recorded by them since 1937 are given in Table 139. From 1937 to 1971, the annual mean catch was 304 a year, showing an almost imperceptible increase over the period. Hughes (1976b) pointed out that the fishing effort had probably also increased, and he concluded that the turtle population was declining. Stoddart (1976) compiled the numbers of turtles imported live from St Brandon to Mauritius recorded in Customs reports, and these figures are also given in Table 139. These two sets of figures, independently compiled, show similar patterns of harvest. From 1945 to 1971, a total of 7221 turtles were reported to have been caught, while 5762 (80%) were imported to Mauritius. Additional turtles were killed for local consumption. Hughes (1976b) reported that each island was permitted to kill two turtles a month for this purpose (a total of 72 turtles a year).

Domestic trade The turtle fishery on St Brandon is run by the Mauritius Fishing Development Company, which was said to buy turtles from the fishermen for US$3 each, selling them in Mauritius for US$29 in 1972. The export price was US$72 each. At the same time, meat sold for US$0.53 a kg, and eggs for US$0.04 each. Very little Hawksbill shell was sold, but it was bought by the Company at US$1 a kg (Frazier, 1980a). In addition to the turtles transported live to Mauritius, the Company also bought calipee from turtles slaughtered in the archipelago. A total of 100 kg, representing the calipee from 40-50 turtles, was bought in 1971 at £0.37 a kg (Hughes, 1976b). Bonnet (1986) reported that stuffed E. imbricata, caught at Rodrigues and Agalega, were sold to tourists on Mauritius for Rs500 each, though other turtle products on sale were thought to have been imported.

International trade Mauritius ratified CITES on 28 April 1975. The only exports of turtle products from Mauritius contained in CITES Annual Reports since 1977 were two shells of C. mydas, one of E. imbricata and one of Cheloniidae, reported as imports by Canada, the USA and the UK. In 1981, the Seychelles reported exporting 11 kg of E. imbricata shell to Mauritius.

Frazier (1980a), writing about 1972, said that no more than 100 kg of Hawksbill shell was exported a year, and also implied that some meat of C. mydas was exported. However Hughes (1976b) reported that only 4.5 kg of

Table 139. Annual catch of turtles at Cargados Carajos recorded by the Mauritius Fishing Development Co. (Hughes, 1976b); and the number of live turtles imported from Cargados Carajos to Mauritius, compiled from Mauritius Customs statistics by Stoddart (1976). * These totals were from all sources, not only Cargados Carajos.

Year	Catch	Import	Year	Catch	Import
1878		21	1945	151	161
1886		43	1946	104	102
1887		42	1947	78	59
1917		28	1948	94	-
1921		27	1949	144	-
1922		119	1950	193	185
1923		202	1951	37	21
1924		82	1952	272	132
1925		109	1953	250	190
1926		150	1954	455	305
1927		19	1955	496	547
1928		0	1956	364	372
1930		0	1957	575	508
1931		0	1958	415	457
1932		245	1959	262	325
1933		62	1960	106	108
1934		252	1961	413	311
1935		167	1962	330	334
1936		275	1963	244	241
1937	336	405	1964	416	331
1938	328	251	1965	-	338
1939	243	-	1966	365	-
1940	556	-	1967	268	-
1941	515	498 *	1968	184	-
1942	426	441 *	1969	341	-
1943	405	410 *	1970	434	420
1944	269	287 *	1971	230	315

tortoiseshell was exported from St Brandon in 1971. The Customs reports of the importing countries that were consulted contained no reference to trade in raw tortoiseshell with Mauritius but, in 1979, India reported exporting 401 kg of worked tortoiseshell to Mauritius. According to Bonnet (in litt., 22 April 1987) stuffed turtles and shell jewellery from South-east Asia are commonly on sale in Mauritius.

RANCHING

Following his investigation of the turtle fisheries of St Brandon, Hughes (1972) recommended the establishment of a farm for *C. mydas*, using facilities at an existing fish farm at Mahebourg, situated on the east coast of Mauritius, some 32 km from St Louis. He advised against obtaining hatchlings from the depleted turtle popuations of St Brandon, suggesting instead that it should come from Europa and Tromelin. In the event, the first batch of hatchlings arrived in 1972 from St Brandon but most were soon eaten by eels in the ponds (Hughes, 1973b). The subsequent history is

uncertain. Newspaper reports indicated that a farm was investigated, and was planned to start in 1983. It is not known whether further turtle stock was ever obtained but, so far as is known, no farm is in existence at present.

LEGISLATION

Fisheries Act, No. 5, 1980.
Establishes fishery controls over all territorial waters, and requires special authorisation for the capture of turtles.

Government Notice No. 18, Fourth Schedule, Toxic Fish, 1983.
Forbids the sale or offering for consumption of the meat of E. imbricata. [It is not certain whether this applies to St Brandon, Agalega and Rodrigues].

POPULATION: Chelonia mydas

Nesting sites Although the species appears to occur around Mayotte throughout the year, known nesting sites are relatively few. Frazier (1985) recorded C. mydas nesting on 17 of the 127 beaches he examined; about 140 beach sites exist in all, with a combined length of some 30 km. North and South Moya beaches, and Papani beach, all on Pamanzi Island (east of Mayotte itself), appear to be the most important nest sites, together with Saziley and several minor sites, around the main island of Mayotte (Frazier, 1985). Bonnet (in litt., 22 April 1987) considers the Moya beaches, and Chariffou, Magikhavo and M'Tsanga in Southern Mayotte to be the most important nest sites.

Nesting numbers Frazier (1985, based on fieldwork in 1972 and 1973) estimated that fewer than 600 females nest annually in Mayotte; see Table 140. Bonnet (pers. comm.) counted 2-3 nesting tracks a night between 10 and 14 June, 1986 on Moya beach, said to be one of the main nesting sites. An aerial survey on the morning of 4 June 1986 found traces of nesting attempts by 27 turtles around the whole island. All of the emergences on Boudrouni beach resulted in successful nesting: 75% on Chariffou and only 50% on Moya north beach. A total of 61 tracks were recorded on the main Mayotte nest beaches over four weeks in August 1986, but only 13 clutches (Bonnet in litt., 22 April 1987). The 1986 data appear to reflect much less C. mydas nesting than was recorded by Frazier in 1972-73.

Table 140. Estimated annual female nesting numbers in Mayotte (data from Frazier, 1985).

Pamanzi Island	
North Moya and South Moya	132
Papani	155
Minor beaches, mostly around Mayotte	275
TOTAL	562

Trends in nesting numbers According to Frazier (1985), there is every reason to suspect that numbers have declined, due to exploitation and habitat loss, but no comparative data are available. Bonnet (pers. comm.) similarly concluded from interviews conducted in 1986 that turtle populations had declined.

Nesting season There may be some nesting throughout the year; fresh nest tracks on Moya beach have been recorded between April and June, older tracks were probably made around late February, and nesting is suspected to extend into mid July. The seasonal pattern appears to be similar to that on Aldabra (and Mohéli), where nesting rises during the trade winds, from May to August, in the austral winter (Frazier, 1985).

Foraging sites Mayotte possesses outstanding reef areas, and extensive shallows with seagrass pastures; foraging C. mydas appear to occur throughout these habitats, particularly in sheltered lagoons with seagrass beds. Juveniles are reportedly common in lagoon areas in the north-east and south (Frazier, 1985).

Migration No direct information is available. Frazier (1985) suggests that the Mayotte C. mydas population may be largely resident, although some interchange of males could occur within the Comores group as a whole.

POPULATION: Eretmochelys imbricata

Nesting sites Although the species appears to be relatively common, and widespread in Mayotte waters, confirmed nest sites are very few. Frazier (1985) records single nests at Saziley, and Papani and South Moya on Pamanzi Island (all these beaches being more important as C. mydas nest sites). Bonnet (pers. comm.) found no evidence of E. imbricata nesting in 1986.

Nesting numbers The nesting population appears to be very small. Whilst Frazier found only three nests in Mayotte (in 1972), additional nesting may occur, but is difficult to monitor accurately.

Nesting season The E. imbricata nesting season in the Comores group appears to extend from late December until May (Frazier, 1985).

Foraging sites Mayotte possesses outstanding reef areas, providing excellent potential feeding habitat for E. imbricata, which is widely distributed around the island. Hawksbills, mostly immatures, were seen in shallow waters in the north-east, east, south and west of Mayotte (Frazier, 1985).

Migration According to Frazier (1985), Mayotte probably has a resident E. imbricata population, possibly augmented by turtles from other parts of the Comores group.

THREATS

There are dogs around all the inhabited beaches and feral populations even on some remote beaches. They are known to dig up eggs and probably also eat hatchlings. Some of the beaches had been affected by sand removal (Bonnet pers. comm., 1987).

EXPLOITATION

Commodity Both C. mydas and E. imbricata are killed for meat, mostly for personal or family use, and some people are said to prefer the latter species. The people of Malagasy extraction generally eat turtle, but many of the Swahili-speakers do not. There is some trade in shell (Frazier, 1985).

Hunting intensity Turtles are killed whenever they are encountered, and their remains can be found all round the island. The most intense hunting was at Moya and Papani beaches. Frazier (1985) estimated that on average about half of the females emerging to nest were killed. Bonnet (pers. comm.) confirmed that poaching still continued in 1986, and found the remains of a dozen turtles on Moya beach, of which five had been killed within the past week. Fishermen were seen on many of the remote beaches, and 80% of beaches examined bore the traces of recent human presence. At least two of the 27 turtles known to have emerged on the night of 3-4 June 1986 were killed by poachers. In August 1986, Bonnet (in litt., 22 April

1987) recorded 42 shells from poached turtles on the nine main Mayotte nest beaches, with hunting intensity highest on Chariffou and Magikhava.

Hunting methods There are no sophisticated techniques for killing turtles, and females are simply turned on the nesting beaches. A small number may be caught at sea by spear or noose. Hunters from one side of the island often camp on beaches elsewhere for a few nights while they are catching turtles. Most of the turtles are butchered on the beaches, and there is considerable wastage of edible meat (Frazier, 1985).

Historical trends There are no separate records of the historical trade in tortoiseshell from Mayotte, but Frazier (1985) concluded that after the French colonisation in the 1800s some large crops were probably taken.

Domestic trade Most of the turtle meat is used for home consumption, but some is sold in the village of Labatoir. A small quantity of salted meat (probably less than 100 kg a year) may be exported from M'Zamboro to other islands in the archipelago. There is not a great trade in tortoiseshell, but in 1972 it could be sold to Indian traders for about US$1.50 a kg (Frazier, 1985).

International trade CITES Annual Reports contain no reference to trade in any animal product from Mayotte, but as there is no accepted ISO code for Mayotte it is possible that importers might have included trade from Mayotte with that from neighbouring countries such as the Comoro Islands or Madagascar.

LEGISLATION

Mayotte was formerly a French Overseas Territory, and when the other Comoro Islands voted for independence in 1974, Mayotte decided to remain a "Collectivité Territoriale" of France, having a status intermediate between an Overseas Department and an Overseas Territory. Contrary to what Frazier (1985) claimed, it is not included in France's acceptance of CITES and it does not form part of the European Community.

Arrêté Préfectoral No. 4, 21 January 1977.
All sea turtles are protected. The penalty for contravention was increased to 1 000 FF in 1986, but enforcement is difficult (Bonnet *in litt.*, 22 April 1987).

MEXICO: CARIBBEAN and GULF OF MEXICO

POPULATION: Chelonia mydas

Nesting sites C. mydas nests in low numbers at scattered sites on the mainland in all the coastal states, and on a number of offshore islands, principally off the Yucatan Peninsula. Available data, mostly from Márquez (1984b and c) are summarised in Table 141.

Nesting numbers The most recent available figures are summarised in Table 141. In 1983 Márquez estimated the 1981 nesting population at beaches investigated in the Gulf of Mexico (Tamaulipas to Yucatan/Quintana Roo in Table 141) as perhaps around 256 females (Márquez, 1984c) and in the Caribbean (Quintana Roo in Table 141) as around 237 (Márquez, 1984b and c), although figures for the offshore cays of Yucatan do not appear to have been included. In 1986 (in litt.) he gave figures of 210-370 nests in three areas in the Gulf of Mexico (Rancho Nuevo, Isla Aguada, Río Lagartos). Parsons (1962) stated that the population nesting on the islands off the north-east of the Yucatan peninsula was second in importance only to Tortuguero in Costa Rica in the whole of the western Caribbean; the most important sites were Isla Contoy, Isla Blanca, Isla Cancún and the uninhabited eastern side of Isla Cozumel. Green turtles were also said to nest at that time in considerable numbers on Cayo Lobos (Banco Chinchorro) off southern Quintana Roo.

Trends in nesting numbers Numbers have evidently decreased, although there is very little historical information. It is thought that the Gulf of Mexico coastline was the nesting area of the Green Turtles that supplied the extensive 19th century Texas turtle fishery which had virtually disappeared by 1900 (Hildebrand, 1981; Carr et al., 1982). The area considered most likely to have been important is the extensive length of coastline between Boca Jesus Maria in Tamaulipas and Tuxpan in Veracruz; this length of coast now holds few nesting Green Turtles (Hildebrand, 1981). Before World War II, Green Turtles are stated to have bred regularly on Playa Washington c. 19 km south of the Río Grande in Tamaulipas but no longer do so (Hildebrand, 1981). In Veracruz, as well as nesting in some abundance north of Tuxpan, especially around Cabo Rojo, Green Turtles are also said to have nested commonly on the coast between Montepio and Cerro San Martin, but are now rare (Carr et al., 1981).

Nesting season Appears to be roughly June-October (Márquez, 1976b, 1984a, b and c).

Foraging sites The most important foraging sites for Green Turtles in the area appear to be off the west and north of the Yucatan Peninsula, north of Laguna del Término and extending over the Campeche Bank. The areas around the offshore cays and reefs (Cayo Arcas-Triángulos, Cayo Arenas-Snake-Madagascar, Arrecife Alacrán) and the Campeche Bank itself are cited as of particular importance (Carr et al., 1982; Márquez, 1984c). The area west of this appears to be of minor importance. Carr et al. (1982) state that the offshore regions of Tamaulipas do not serve as regular feeding habitat for any species of sea turtle, and that C. mydas is very rare in coastal waters off Veracruz, although Caretta and Eretmochelys are reportedly more abundant there. Juvenile and mature C. mydas are reportedly taken off the Tabasco coast, but only in very small numbers. Márquez (1984c) cites the areas off Nautla-Cabo Rojo and around the Arrecife Cabezo (both off Veracruz) as turtle foraging sites and includes C. mydas in the

Table 141. Nest sites and estimated number of C. mydas nests in the Gulf of Mexico and Caribbean Mexico. Key to references cited: (1) Márquez (1984c), (2) Márquez (in litt., 10 December 1986), (3) draft IUCN/UNEP Coral Reef Directory, (4) Carr et al. (1982), (5) Márquez (1984b), (6) Parsons (1962), (7) Márquez et al. (1987).

Region	Beach length (km)	Nests/month (Observed)	Nests/season (estd.)	Period of observation	Ref.
TAMAULIPAS					
Washington-San Rafael	88	5	?	May-August	(1)
San Rafael-La Pesca	121	15 (June)	?	May-August	(1)
Rancho Nuevo	69		10-20		(2)
" "		3 (June)	5	May-July	(1)
El Tordo-Barra Chavarría	28		10	May-July	(1)
VERACRUZ					
Tampico-Tuxpan	62	3	20	June-August	(1)
Tuxpan-Veracruz	63	15 (June)	?	May-August	(1)
VERACRUZ/TABASCO					
Veracruz-Frontera	27	2 (June)	40	May-August	(1)
CAMPECHE					
Carmen-Sabancuy incl. Isla Aguada	60	1 (June)	50	June-Sept.	(1)
Isla Aguada	?		102-103	April-Sept.	(7)
Sabancuy-Celestun Norte	67		50		(1)
YUCATAN					
Celestun-Río Lagartos	72	3 (June)	50	May-August	(1)
Río Lagartos	?		100-150		(2)
Arrecife Alacrán (Pérez, Pájaros, Desertora)	?		?		(3)
Cayo Arenas	?		?		(4)
Los Triángulos	?		?		(4)
Cayo Arcas	?		?		(4)
YUCATAN/QUINTANA ROO					
Río Lagartos-Cabo Catoche	92	4 (June)	40		(1)
QUINTANA ROO					
Cabo Catoche-Sargento	12.4		30	June-August	(5)
Nizuc-Puerto Carmen	35	4 (July)	20	June-August	(5)
Puerto Carmen-Tulum	19	6 (July)	50	June-August	(5)
Tulum-Bahía Ascención	18	1 (July)	25	June-August	(5)
P. Norte, B. Espiritu Santu - Xcalac	25	2 (July)	20	June-August	(5)
Isla Blanca	2.4		?	June-August	(5)
Isla Contoy	1.9	5	20	June-August	(5)
Isla Mujeres	4.0	4	12	June-August	(5)
Isla Cozumel	18	20 (6 in July)	60	June-August	(5)
Isla Cancún	?		?		(6)
Cayo Lobos (Banco Chinchorro)	0.3		?		(6)

species listed, but gives no indication of abundance. The importance of the area off the eastern coast of the Yucatan Peninsula (Quintana Roo) is unclear. Carr et al. (1982) state that fringing reefs and seagrass beds are abundant here, though cite them as foraging habitat for Caretta and Eretmochelys without specific mention of C. mydas. Márquez (1984b) lists the following areas: Cabo Catoche-Arrowsmith (c. 13 400 sq. km); north Cozumel (c. 470 sq. km); Bahía Ascención (c. 560 sq. km); Bahía Espiritu Santu (c. 450 sq. km); Banco Chinchorro (c. 565 sq. km); Bahía de Chetumel (c. 2600 sq. km). He also cites C. mydas among the species occurring in each of these areas but again gives no indication of abundance.

Migration Little information. It is hypothesised that the turtles which were caught off the coast of Texas in the 19th century (mostly in Aransas and Matagorda Bays and the lower Laguna Madre) nested in Tamaulipas and northern Veracruz (see above). As of 1982, 24 turtles (presumably all C. mydas) tagged at the nesting beaches of Tortuguero in Costa Rica had been recovered in foraging areas off north-east Quintana Roo, sufficient to imply a regular, if small scale, migration between these areas (overall tag returns indicate that the great majority of the Tortuguero population forages off Nicaragua) (Carr et al., 1978; Carr et al., 1982). A single C. mydas tagged on Aves Island (Venezuela) in the eastern Caribbean has been recovered off Isla Mujeres (Meylan, 1981).

POPULATION: Eretmochelys imbricata

Nesting sites Areas where Eretmochelys is known or believed to nest are given in Table 142; most information is from Márquez (1984b and c). Two areas of relatively concentrated Hawksbill nesting are known: Isla Aguada and Río Lagartos. The former extends for some 40 km between the eastern mouth of Laguna de Terminos east to Sabancuy (Campeche; the latter for some 60 km between Río Lagartos and Cuyo (Yucatan). Isla Aguada, with 306 and 191 nests in 1985 and 1986 respectively (Márquez et al., 1987), representing some 60-100 females a season (assuming three clutches per female), is currently the largest known Hawksbill nesting population in the entire wider Caribbean (Meylan, in press). The Río Lagartos area held 114, 82 and 97 nests in 1985, 1986 and 1987 (Castañeda Alvarado, 1987; Meylan, in press).

Nesting numbers Estimated number of nests are given in Table 142 below. Márquez (1984b and c) estimated that there may have been around 480 nesting females at investigated sites in the Gulf of Mexico region (Tamaulipas to Yucatan/Quintana Roo in Table 142) in 1981 and a further 88 or so on the Caribbean coast of Mexico (Quintana Roo and offshore islands). In 1986 (in litt.) he estimated 350-500 nests at two sites in the Gulf of Mexico, Isla Aguada and Río Lagartos (Castañeda Alvarado, 1987; Márquez et al., 1987).

Trends in nesting numbers Little information is available. Carr et al. (1982) stated that the Hawksbill (along with the Green Turtle and Loggerhead) formerly nested abundantly on the coast between Montepio and Cerro San Martin in Veracruz but now rarely did so. Hildebrand (1981) wrote that the population on the islands from Isla Lobos to Anton Lizardo off the coast of Veracruz had persisted at low level for the past 25 years, despite constant exploitation.

Nesting season Little information. Márquez (1976b) states that at Isla Contoy off Quintana Roo the species lays from April to July. At Río Lagartos, Yucatan, nesting occurs mainly May-September (Castañeda Alvarado, 1987). Peak nesting on Isla Aguada is in June (Márquez et al., 1987).

Table 142. Nest sites and estimated numbers of Eretmochelys imbricata nests in the Gulf of Mexico and Caribbean Mexico. Key to references: (1) Márquez (1984c), (2) Hildebrand (1982), (3) Márquez et al. (1987), (4) Wells (1988a), (5) Carr et al. (1982), (6) Márquez (1984b), (7) Castañeda Alvarado (1987). Beach lengths given are those suitable for nesting.

Region	Length (km)	Nests/month (Observed)	Nests/season (estd.)	Period of observation	Ref.
TAMAULIPAS					
El Tordo-Barra Chavarría	28		?		(1)
VERACRUZ					
Tuxpan-Veracruz	63		?		(1)
Islands from Isla Lobos to Anton Lizardo	?		?		(2)
VERACRUZ/TABASCO					
Veracruz-Frontera	27		?		(1)
CAMPECHE					
Carmen-Sabancuy	60	56 (June)	300	May-August	(1)
Isla Aguada			281-460	May-Sept.	(3)
Sabancuy-Celestun Norte	67	6 (June)	100-200	May-August	(1)
YUCATAN					
Celestun-Río Lagartos	72		50	May-August	(1)
Río Lagartos	60		114	May-Sept.	(7)
Arrecife Alacrán (Pérez, Pájaros, Desertora)	?		?		(4)
Cayo Arenas	?		?		(5)
Los Triángulos	?		?		(5)
Cayo Arcas	?		?		(5)
YUCATAN/QUINTANA ROO					
Río Lagartos-Cabo Catoche	92		30		(1)
QUINTANA ROO					
Cabo Catoche-Sargento	12.4		10	June-August	(6)
Nizuc-Puerto Carmen	35		10	June-August	(6)
Puerto Carmen-Tulum	19		12	June-August	(6)
Tulum-Bahía Ascención	18		20	June-August	(6)
P. Norte B. Espiritu Santu - Xcalac	25		12	June-August	(6)
Isla Blanca	2.4		?	June-August	(6)
Isla Contoy	1.9	4	12	June-August	(6)
Isla Mujeres	4.0	1	3	June-August	(6)
Isla Cozumel	18	3	9	June-August	(6)

Foraging sites The most important foraging areas appear to be those off the Yucatan Peninsula, both in the Gulf of Mexico and in the Caribbean, and extending northwards on the Banco de Campeche, although good Hawksbill habitat is also said to be present off the coast of Veracruz, particularly

around islands between Isla Lobos and Anton Lizardo and around Arrecife Cabezo (Carr et al., 1982; Márquez, 1984b and c). Márquez (1984a and b) cites Eretmochelys as occurring in the same foraging areas as Chelonia mydas (q.v.), although again with no indication of relative importance. Juveniles and adults are found in very small numbers off Tabasco; there are reportedly no regular feeding grounds off Tamaulipas for any species of sea turtle (Carr et al., 1982).

EXPLOITATION

N.B. For Chelonia mydas, the Pacific fishery is of considerably greater importance in Mexico than that in the Gulf of Mexico and the Caribbean. A fuller discussion of C. mydas utilisation in Mexico is provided under the section on Mexico: Pacific.

Commodity In Mexico, meat, oil, eggs and hide of both Eretmochelys and C. mydas have been used and traded in, as well as considerable quantities of tortoiseshell from Hawksbill (Carr et al., 1982; Márquez, 1976a).

Hunting intensity Data post-1981 are lacking, although it is evident that hunting intensity has been high until recently, particularly in Campeche on the west coast of the Yucatan Peninsula and Quintana Roo on the east coast of Yucatan (Carr et al., 1982; Márquez, 1976a). Whether it remains so is unclear, although Carr et al. (1982) and Hildebrand (1981) noted that the harvest in Campeche had declined dramatically in the previous ten years. The most recent harvest figures for C. mydas indicate that in 1980 312 were taken in the Gulf of Mexico (Tamaulipas to Yucatan) and 100 in Quintana Roo (official fisheries figures, quoted in Márquez, 1984b and c). A further 100 were reportedly taken in Quintana Roo in 1981; no official harvest in the Gulf of Mexico is recorded for 1981, although it is not clear if this is because the fishery was closed or if statistics were not available. However an estimate of 50 taken as incidental capture by shrimp trawlers and in trammel nets is given for that year (Márquez, 1984c). No official Hawksbill fishery is recorded since they are protected, although an estimate of 50 taken as incidental capture in the Gulf of Mexico is also given for 1981 (Márquez, 1984b).

The following comments for each of the coastal states have been located:

Tamaulipas Hildebrand (1981) noted that commercial landings of turtles have reportedly always been small but exploitation, particularly of eggs, has been very heavy; few nests were overlooked outside the well-protected beach of Rancho Nuevo (where the critically endangered Lepidochelys kempi nested).

Veracruz The turtle fishery along the heavily populated coast of the state has always been intense, although largely of a subsistence nature; the official catch is low (Hildebrand, 1981; Márquez, 1976a). Nets were still in use near the city of Veracruz in 1979, although Hildebrand noted that the expectation of the fishermen was low; he cites one village where only five turtles (at least two of them C. mydas) were taken during the whole of the 1979 season.

Tabasco Although taken whenever encountered, harvesting of turtles has reportedly never been extensive (Carr et al., 1982; Hildebrand, 1981).

Campeche As noted above, Campeche has been the most productive state in the region. Hildebrand (1981) notes that in part this is due to the presence of two major fishing ports and more qualified fishermen than in any other state on the east coast of Mexico, but also due to the waters here being more productive than elsewhere.

Yucatan The extent of the catch was unclear, although incidental take by shrimp trawlers was likely to be high (Carr et al., 1982).

Quintana Roo Along with Campeche, Quintana Roo has been a long-standing centre for commercial turtle exploitation, with Isla Mujeres off the north-east coast an important base (Parsons, 1962 and 1972). According to official harvest figures, Quintana Roo was the most productive state for overall turtle harvest (i.e. all species) in eastern Mexico during the 1960s, producing an average of 126 tonnes per year for 1963-70 compared with c. 25 tonnes per year in Campeche (the next most important state) in the same period. C. mydas was the most important species taken, followed by Caretta caretta and, sporadically, Eretmochelys (Márquez, 1976a). Figures for the 1980 and 1981 harvests are given above. In addition to deliberate taking of turtles, shrimp trawling was heavy along the north-eastern coast and was likely to take some (Carr, 1981).

Hunting methods Turtles are taken with nets, with harpoons, by direct capture in the water and by turning on nesting beaches (although this last activity is illegal) (Márquez, 1976a). Use of nets and harpoons is similar to that described for Pacific Mexico (q.v.). Carr et al. (1982) noted that the use of nets set specifically for turtles was most prevalent in Veracruz, especially near Veracruz city and Montepio, and around the Yucatan peninsula. Off Campeche nets were set for Hawksbills and Loggerheads near the shore over rocks in 30-40 ft (c. 9-12 m) of water and off Quintana Roo nets were set in c. 45 ft (13.7 m) in areas where turtles were known to have regular sleeping refuges. Considerable numbers are also evidently taken by shrimp trawlers in these areas. Carr et al. (1982) describe how on Isla Mujeres, off the Quintana Roo coast, where there is a long tradition of turtle harvest and processing, females captured alive in nets during the breeding season were placed in a turtle crawl which allowed access to a nesting beach; they were then allowed to lay their eggs before being slaughtered. This practice continues but at the end of the nesting season most turtles (about 50 annually) are tagged and released; 10 000-20 000 hatchlings are obtained and released annually (Márquez in litt., 29 August 1988).

Historical trends There is a long tradition of sea turtle exploitation on the eastern seaboard of Mexico, particularly in the Yucatan peninsula.

Parsons notes that in 1554 the inhabitants of at least one coastal village in the Bay of Campeche were ordered to pay a tribute of five "tortugas" (probably C. mydas) every two months. In the 18th century it was the custom of Jamaican logwood cutters at Campeche to keep a reserve of live Green Turtles in pens or crawls, many of which were exported to Jamaica where they were particularly in demand as food for plantation slaves (Parsons, 1962).

Juan de Grijalva's expedition to the coast of the Yucatan Peninsula in 1517 encountered Indians carrying shields made of Hawksbill shells. In 1658 De Rochfort (cited in Parsons, 1962) stated that the best fishing for caret (tortoiseshell) in the Caribbean was on the Peninsula of Yucatan and the islands of the Gulf of Honduras. English boats from Jamaica frequented the peninsula at this time seeking tortoiseshell (Parsons, 1962).

In 1896 the turtle processing plant which had been sited in Texas (see relevant account) was relocated to Tampico in extreme northern Veracruz, apparently because turtles were by then more easily obtainable there than in the northern Gulf of Mexico (Hildebrand, 1981). The subsequent fate of the plant is unknown.

Although detailed information is lacking, it seems that considerable numbers of Green Turtles were exported from Mexico to the USA in the first half of the present century. Parsons (1962) notes that exports to the USA from Isla Mujeres, the centre of the turtle industry on the Caribbean side of the Yucatan Peninsula, numbered as many as 2000 a year. In the 1950s, however, it seems that this trade declined, with claims that taxes and export duties made the trade uneconomical. In 1956 there were reportedly several hundred turtles in the crawls at Isla Mujeres for which it was said that no market could be found (Parsons, 1962).

Official figures for C. mydas production for 1948-73 from the eastern seaboard of Mexico are given under C. mydas in Table 144 (figures for Pacific Chelonia are given under C. agassizi). In contrast to the Pacific, there appears to be relatively little underlying trend for the period 1948-1970, although shorter-term trends are discernible: from 1948 to 1952, over 250 tonnes of fresh meat were produced each year (mean 306 tonnes per year); production then dropped to below 200 tonnes per year from 1953 to 1959 (mean 127 tonnes per year); the years 1960-62 were again high production (over 300 tonnes per year, mean 383 tonnes per year); post 1962, production has again been low (mean of 97 tonnes per year for 1963-1971 and 1973, there being no legal harvest in 1972), with the lowest recorded harvests for the whole period in the two most recent years (30 tonnes in 1971, 40 in 1972).

The drop in production in the early 1950s accords with Parsons's observation above and could thus perhaps be explained by a drop in demand from the export market, implying that much of the officially recorded harvest was export-led at that time. Until 1955 the eastern Green Turtle harvest considerably exceeded the officially recorded harvest on the Pacific coast (totals for 1948-55 inclusive of 2020 tonnes and 530 tonnes respectively). Since then, the Pacific harvest has become of far greater importance, and has exceeded that on the east coast in all years for which records are available except 1960.

As noted above, official figures indicate that 412 Green Turtles were taken in the region in 1980. Total weight of the 312 taken in the Gulf of Mexico was 15 427 kg; assuming the 100 taken in the Caribbean weighed on average the same, overall harvest was c. 20.4 tonnes. Assuming this figure is equivalent to "live weight" production in Table 144, then the harvest is smaller than, but of the same order of magnitude as, that recorded in 1971 and 1973.

Accounts of the present rarity of Eretmochelys off Pacific Mexico strongly imply that most, if not all, official production post 1963 is from the eastern seaboard of Mexico; it is possible, however, that some of the production recorded in 1953-56 originates on the Pacific coast - Eretmochelys was reportedly fairly abundant there at that time and tortoiseshell was processed in Baja California (see account for Pacific Mexico). Officially recorded national production of tortoiseshell from E. imbricata was very erratic in the period 1948-70 (Table 144), with four years when production exceeded one tonne (1954, 1955, 1968, 1973), nine years when annual production was less than 0.3 tonnes and two periods when

no production at all was recorded (1948-52, 1957-63). Márquez (1976a) considered that declines in production were induced by the introduction of plastics leading to a decline in demand, though also noting that since the mid-1960s demand had evidently increased again - highest recorded production was in the most recent year for which figures were available (4.87 tonnes in 1973).

Carr et al. (1982) noted that large amounts of tortoiseshell jewellery and ornaments were on sale in the towns of Veracruz (where whole stuffed turtles were also on sale), Campeche and Merida. In 1978 Mortimer visited a workshop in Veracruz and was told that raw carey (Eretmochelys) shell was becoming difficult to obtain both because it was illegal and because the turtles were becoming scarce; the workshop was thus reducing the production of tortoiseshell jewellery and concentrating on plastics (Carr et al., 1982).

International trade See Pacific Mexico below.

MEXICO: PACIFIC

POPULATION: Chelonia mydas

Nesting sites Large scale nesting is, or has been, apparently confined to the coast of Michoacán (Cliffton, 1984; Alvarado and Figueroa, 1986). Márquez (1976b) also reports nesting at the following sites: the 63 km Playa de Mismaloya between Ipala and Roca Negra in Jalisco (Márquez, 1976b; ; the 12 km Playa de Piedra de Tlacoyunque between Morro de Papanoa and Barra de San Luis in Guerrero; the 7.5 km Playa de la Escobilla between the Cozoaltepec and Tonameca Rivers in Oaxaca

In Michoacán, nesting is reported in the area between Faro de Bucerias (18°19'N, 103°29'W) and the delta of the Río Nexpa (18°08'N, 102°58'W), a distance of c. 60 km (Alvarado and Figueroa, 1986). Fifteen beaches within this stretch are used, with large-scale nesting occurring on two, Colola and Maruata (Alvarado and Figueroa, 1986) Colola is an open unprotected beach running east-west, 4.8 km long and 350 m wide; Maruata, located in Maruata Bay, also runs east-west and has a length of 2.24 km and maximum width of 40 m.

Nesting takes place in some number on Socorro and Clarion in the Revilla Gigedo Islands. In 1976 nesting density of 0.027 per sq. m was estimated at Bahía Sulfur on Isla Clarion; the size of the nesting beach is not given, although at least 13 female turtles visited the nest in three days in October of that year (Awbrey et al., 1984). Beebe (cited in Parsons, 1962) observed 50 Green Turtles engaged in courtship activities off the coast of Clarion in May 1937; a few days later he counted 40 fresh tracks on a beach on the south side of the island. Clarion was uninhabited at that time, and no reference was made to exploitation there.

There are early 18th century records (cited in Parsons, 1962) of large numbers of turtles nesting on the Tres Marías Islands off the Nayarit coast; their identity remains in some doubt. Edward Cooke who visited the islands in October 1709 identified them as Green Turtles and noted that they were so abundant that two men could turn a hundred in a night; Parsons notes, however, that later accounts refer to the Tres Marías as a refuge for Hawksbills Eretmochelys imbricata (q.v.). The present status of turtle populations here, if any, remains unknown.

The presence of nesting on Baja California remains conjectural. Caldwell (1963) noted that there were "nebulous references" to Green Turtle nesting on many beaches along southern Baja California and in the Gulf of California, but also added that there were no recent records of nesting. Márquez (in litt., 29 August 1988) confirmed this.

Nesting numbers Recent figures are available only for the Michoacán population. Alvarado and Figueroa (1986) estimated that c. 600 nested on four beaches (Colola, Maruata, Chimapa and Motin del Oro) in Michoacán in 1985. Data from earlier seasons indicated that these beaches held c. 50% of the female breeding herd nesting in Michoacán, which was thus estimated to amount to c. 1200 females in that year. Figures for earlier years, presumably derived using the same techniques are given in Table 143.

Table 143. Estimated numbers of female Chelonia mydas nesting in Michoacán, 1981-85 (Alvarado and Figueroa, 1986 and 1987).

Year	Estimated number of nesting females
1981	5586
1982	4483
1983	1000
1984	940
1985	1200
1986	3334

It is unclear to what extent figures given for years earlier than these are comparable. Cliffton et al. (1981) quote an estimate of 600 turtles nesting in Maruata Bay in 1979; it is not clear if this includes Colola beach. For Colola beach they note that 50-150 nested per night in October and November 1979, compared with 7-30 per night on the same beach in October and November 1977.

Márquez (1976b) stated that c. 2000 females nested each season at the Playa de Mismaloya in Jalisco with perhaps 500 each at the Playa de Piedra de Tlacoyunque and the Playa de La Escobilla. More recent information on these populations is lacking.

Trends in nesting numbers Figures quoted above indicate that in Michoacán, as elsewhere, marked fluctuations in nesting numbers can occur from season to season; the 75% decline from 1982 to 1983 noted above has been ascribed to "El Niño" which swept through the Pacific in 1983. The overriding trend, however, appears to be of a drastic long-term decline. Cliffton et al. (1981) quote local Nahuatl Indian informants as stating that ten years previously (i.e. in 1970) 500-1000 Green Turtles nested each night during the breeding season at Colola beach; extrapolation from this gives a figure of perhaps 25 000 female C. mydas nesting in Michoacán at that time. Earlier observations tend to corroborate this - Peters (cited in Cliffton et al., 1981) reported tracks of around 250 turtles on half a mile (0.8 km) of beach at Maruata Bay in August 1950, some two months before peak nesting. Cliffton et al. take this to indicate c. 900 turtles nesting in Maruata Bay within several days of Peters's observations, this figure being 50% higher than the number estimated nesting in the bay in the entire 1979 season.

Nesting season Nesting season at present in Michoacán extends from September to December (Alvarado and Figueroa, 1986); it has evidently extended into August in the past (see above). However, Brand (cited in Parsons, 1962) stated that he had seen turtles (by implication C. mydas) nesting on beaches from February to August. Nesting was recorded in October on the Tres Marías Islands (assuming the species to be C. mydas) and on the Revilla Gigedo Islands in May (Beebe, cited in Parsons, 1962).

Foraging sites There are important feeding grounds in northern Mexico, within the Gulf of California and along the Pacific coast of Baja California. Cliffton et al. (1981) note that historically C. mydas was abundant along the coasts and in the large bays, saltwater lagoons and deltas of Baja California, Sinaloa and Sonora, also entering the Colorado River where there are records from 80 km upstream. Carr (1961, cited in Parsons, 1962) states, on the basis of examination of stomach contents, that turtles here feed principally on algae rather than on eel grass and turtle grass; others (Felger and Moser, 1973; Felger, Moser and Moser, 1980) state that they feed on eel grass (Zostera marina), ditch grass (Ruppia maritima), marine algae and white mangrove leaves (Laguncularia racemosa). Fishermen in the area note a similar decline in turtle numbers here (a 10-20 fold decrease) since the 1950s to that reported from the nesting grounds in Michoacán. An indication of previous abundance is given by harvest figures: in 1889 the Albatross visited San Bartolomé or Bahía Tortugas on the Pacific Coast of Baja California at 27°45'N; here 162 Green Turtles "many of large size" were landed in a single haul of a 600-ft-long seine. Half as many again were believed to have escaped before the net was beached. At the turn of the century an estimated 1000 live turtles a month were sent to San Diego from Laguna Ojo de Liebre (Scammon's Lagoon).

Harvest figures for the area from the 1950s indicate that most turtles were collected from Baja California from localities including Laguna Ojo de Liebre, Bahía San Bartolomé, Bahía de los Angeles, Bahía Magdalena (Puerto Alcatraz) and Bahía San Ignacio (Mercado cited in Parsons, 1962). Most of those collected were taken north along the peninsula, implying that turtles were genuinely more abundant in the south than in the north. Some were taken every month, though most were harvested in June, July and August; Parsons (1962) also stated that Green Turtles were only found in the warm waters of the Gulf of California during the summer months (but see below).

Overwintering sites In the early 1970s large numbers of overwintering Green Turtles were discovered off the south shore of Tiburón Island in the Gulf of California off the Sonoran coast; the turtles were lying motionless at depths of 10-30 m. Exploitation of these turtles began in 1975 and by 1980 they had reportedly been drastically depleted (see below).

Migration Tagging returns from turtles marked at the Michoacán breeding sites indicate that there may be two subpopulations nesting here, one feeding in the Gulf of California and adjacent waters (see above) and the other foraging south off Central America: as of March 1986, of the 28 female Chelonia tagged at Michoacán which had been recovered and reported away from the nesting grounds, 22 were recovered from Central America (16 from El Salvador, four from Guatemala, one from Nicaragua, one from Costa Rica), one from Colombia and five from waters off Mexico north of Michoacán (two from the Gulf of California, two from Sinaloa, one from the Islas Tres Marías) (Alvarado and Figueroa, 1986 and 1987).

MEXICO

POPULATION: Eretmochelys imbricata

Nesting The Hawksbill was once reportedly common along the Pacific coast of Mexico and may have nested at scattered localities south of the desert coast of Sonora; it is now rare and there are apparently no known nesting beaches (Cliffton et al., 1981). According to early 18th century reports, the Tres Marías Islands may possibly have once been a major nesting ground; however the identity of the turtles involved is open to doubt and they may have been Chelonia mydas rather than Eretmochelys (see above).

Foraging Hawksbills still occur in Pacific Mexican waters; Cliffton et al. (1981) noted that during the previous six years they had encountered around a dozen captured by fishermen in the Kino Bay region of the Sonoran coast in the Gulf of California and three taken in a single season off the Michoacán coast. Fishermen reported that 20-30 years previously Hawksbills were abundant in the Gulf of California but were intensively hunted; hunting activities were concentrated in La Paz and Concepcion Bay on the east coast of Baja California and the Infiernillo Channel on the Sonoran coast north of Kino Bay.

THREATS

Excessive exploitation is the overwhelming threat to sea turtles on the Mexican Pacific coast, and has evidently caused dramatic declines in numbers, particularly of C. mydas, over the present century. Some turtles are taken as incidental catches by shrimp and high seas fishing boats, although the extent of this and the effect on the population remains unknown. As noted above, "El Niño" is believed to have been the cause of the marked decline in numbers of C. mydas nesting in Michoacán in 1983; whether it caused extensive mortality or simply suppressed breeding is unclear. The beaches at Maruata have been affected by the construction of a road running along the back of the beach; predation of nests by feral and domestic animals is also a problem (Cliffton et al., 1981).

EXPLOITATION

Commodity The principal commodities used at present are C. mydas meat, eggs and leather. C. mydas meat is particularly, and it seems increasingly, sought after in the northern Mexican states of Sinaloa, Sonora and Baja California; here turtle meat and blood are associated with health, vigour and sexual potency. Caldwell (1962b) reported that the flesh of male turtles was said to have a purgative effect on humans; he was told during investigations at Los Angeles Bay in the Gulf of California that females were preferred because of the taste and texture of their flesh, and that immatures of either sex were equally good. Turtle eggs are believed to have aphrodisiac qualities and are in widespread demand in Mexican cities. Demand for leather appears to come principally from the export market; such demand increased greatly in the 1960s and 1970s (see below).

Turtle oil has been valued in Mexico since pre-Columbian times for its supposed therapeutic qualitities in treating human chest complaints, especially tuberculosis and leprosy (Caldwell, 1963); Craig, writing in the 1920s (cited in Caldwell, 1962b) stated that sea turtles (likely to have been mainly C. mydas) landed at San Felipe in the north-western Gulf of California were taken principally for their oil. Given the present high value of turtle meat this is unlikely still to be the case.

Until the 1950s tortoiseshell from Hawksbills was traded in: fishermen on the east coast of Baja California would capture Hawksbills and sell the tortoiseshell to local prisons where it was crafted into combs, pendants, rings and other ornaments for sale. At present Hawksbills when captured are reportedly cleaned and stuffed to be kept as curios or sold to Mexican or North American tourists; the meat is eaten (Cliffton et al., 1981).

Hunting intensity Hunting intensity in general appears very high, although stocks are severely depleted.

In Michoacán, Alvarado and Figueroa (1986) estimated that some 350-500 adult C. mydas (mostly males) were taken, illegally, in the winter of 1985/86 despite efforts to prevent such poaching. This was a considerable increase over 1984/85, when an estimated 240 (again mostly males) were taken, this representing c. 60 each month of the breeding season (September-December) (Alvarado and Figueroa, 1986). Until the initiation of protective measures in the early 1980s, the egg harvest at Michoacán was extremely heavy (see "Historical trends" below).

There are few very recent data on harvests in the northern feeding grounds, although it is evident that hunting pressure is severe. Cliffton et al. (1981) noted that by the late 1970s, the Seri Indians of the Sonoran coast in the Gulf of California had "virtually extirpated" the remaining sea turtles from their region; as an indication of hunting efficiency they note that, of 13 adult and subadult C. mydas tagged in the Infiernillo Channel in March 1977, seven had been captured by the Seri by May 1977.

Intensive hunting of overwintering turtles in the Infiernillo Channel and adjacent areas by Mexican fishermen of the Kino Bay region began in 1975. In that year five turtle boats (pangas) were landing 4-5 tonnes of turtles/week (c. 160 turtles, mean weight 29 kg/turtle) from late November to early March. Overwintering sites were successively depleted and by the end of 1979 Kino Bay divers reportedly travelled three times the distance and invested many times the hunting effort to obtain far smaller catches, although the greatly increased value of turtle meat still made hunting profitable (Cliffton et al., 1981).

Hunting methods Sea turtles are principally hunted with nets, by harpoon and by direct capture while swimming and, in the past at least, by "turning" females on nesting beaches.

Nets are used principally in the Caribbean, the Gulf of California, the south-west coast of Baja California and, recently, in Jalisco and Michoacán. Nets are usually of monofilament nylon, though sometimes of cotton. They are of variable size, generally over 50 m long, with a wide mesh (70-90 cm internode distance) and supported by buoys at c. 2 m distance; the depth of the net varies from 4 to 12 m. The base of the net is weighed down with small stones or lead weights, these being sufficiently light that turtles, once trapped, can still swim relatively easily to the surface to breathe (Márquez, 1976a).

Nets may be set parallel or perpendicular to the shore, depending on local conditions; they are generally placed no further than 4 miles (6.4 km) off shore and in areas with little current, as their lightness makes them prone to drifting. Nets are usually set in the evening and checked each morning, as trapped turtles are vulnerable to attack from sharks. Simple harpoons may be used to facilitate loading of the turtles onto the boats (Márquez, 1976a).

Caldwell (1963) gives a detailed account of traditional harpoon hunting techniques as used by the Seri Indians in the Gulf of California. This method is still in use today (M.C.R. Márquez in litt., 29 August 1988).

Hunting is carried out from 6-7 m-long plank boats ("pangas") usually manned in pairs. Outboard motors (25-50 h.p.) are used to propel the boats to the fishing grounds, while wooden paddles are used during fishing. Turtles are generally (but not necessarily) sought at night and are observed with the aid of lanterns as they sleep or swim at the surface; they are also sometimes tracked by the trails of phosphorescence they leave as they swim just below the surface. The turtles are taken with a harpoon whose wooden shaft may be up to 10 ft (3 m) long (the quote of 7-10 m quoted in Cliffton et al. (1981) is presumably in error). The harpoon's detachable metal head is held on to the shaft by a friction connection and backward pull on the harpoon line which is held tightly along the shaft by the harpooner. Efforts are made to prevent serious injury to the turtles, which must often be kept alive for several weeks: the shaft of the harpoon head behind the barbs is encircled with leather or rubber washers to prevent the head penetrating too deeply and damaging the vital organs; the hole resulting from penetration of the harpoon head is usually plugged with cloth or thick mud. Harpooners generally try to strike the turtles in the posterior end to minimise the chance of inflicting severe injury.

Turtles are transported alive and when returned to shore are released belly-up for a day or so, this reportedly making them quiescent. They are then placed belly-down on the sand floor of a shaded pen near the water's edge and kept until needed. In winter they may be held as long as two weeks with few deaths, although in summer heavy mortality may ensue in three or four days. Turtles captured in the southern parts of Baja California are more generally kept in pens built in the water or on tidal flats that are flooded each day.

Two other techniques have been used for C. mydas: in 1975 fishermen from Kino Bay began using compressor diving techniques to capture overwintering C. mydas off Tiburón Island (Cliffton et al., 1981) and in Michoacán, whilst most turtles have been captured using shark gill nets, often set directly in front of the nesting beaches, they are also taken by pouncing on mating pairs, a technique known as "al brinco" - in rut the turtles are reportedly "almost completely beyond any concern for self-preservation" (Cliffton et al., 1981) and are thus easily taken.

Historical trends

A. Pre-1948

Sea turtles have been used by the coastal inhabitants of Pacific Mexico since pre-Columbian times. At least until the end of the 19th century Green Turtles were the single most important source of food for the Seri Indians of the Sonoran coast in the Gulf of California. McGee (cited in Caldwell, 1963) notes that not only were they used in varied ways for food but also their shells were used to cover living shelters and the flipper integument formed the Seri's only known footwear.

Ships, especially whalers, using coastal waters in the region would provision themselves with turtle meat; 18th century accounts indicate that large numbers were sometimes taken at once - viz Edward Cooke's account (in Parsons, 1962) of a voyage in 1709 when two men could "turn" 100 turtles

(Chelonia mydas or perhaps Eretmochelys) in a night on the Tres Marías Islands. This harvest must have been intermittent and seems highly unlikely to have had a detrimental effect on turtle populations.

Large-scale commercial exploitation of Green Turtles in the northern Mexican feeding grounds evidently began in the 19th century, considerably earlier than at the Michoacán nesting grounds. It is implied (though not definitely stated) in both Parsons (1962) and Cliffton et al. (1981) that until the 1950s most commercial harvesting was on the west (Pacific) coast of Baja California.

Parsons (1962) notes that a turtle cannery, run by a Joseph P. Hale of San Francisco, was in operation in 1891 on a small island in Bahía Magdalena, some 250 miles (400 km) south of Turtle Bay on the west coast of Baja California; at this time canned "extract" of Green Turtles was exported to England and live turtles were shipped to San Francisco. By 1906 the cannery was reportedly abandoned, although monthly shipments of live Green Turtles were still being made to San Francisco on ships of the Pacific Coast Steamship Company (Parsons, 1962); concern was already being expressed that unrestricted exploitation would result in the destruction of the resource (Parsons, 1962). Shortly afterwards San Diego developed as a fishing and canning centre; O'Donnell (cited in Cliffton et al., 1981) estimates that c. 1000 live turtles per month were sent to San Diego from Scammon's Lagoon (Laguna Ojo de Liebre) in the early years of the century. In 1920 some 15 000 cases of turtle were reported canned in San Diego plants (presumably most or all from Mexico, and most likely to have been C. mydas); however Mexican legislation brought an end to this industry by 1923 (Parsons, 1962).

B. 1948-present

Figures for the Mexican turtle fishery from 1948-73 are summarised in Márquez (1976a). Figures for Chelonia are given under C. mydas and C. agassizi; it is assumed that those for C. mydas apply to the Caribbean and Gulf of Mexico Green Turtle populations and those for C. agassizi to those of the Pacific and Gulf of California.

Márquez, writing in 1976, characterised the Mexican Turtle fishery for 1948 to 1974 as falling into four main phases:

i. Relatively low, stable (i.e. sustainable) harvest for 1948-59;

ii. Harvest tending to increase, from 1960 to 1966;

iii. Maximum exploitation 1968-69;

iv. Rapid decline in harvest from 1969 to 1974, with a slight tendency towards stabilisation;

This trend is followed relatively closely by the Pacific C. mydas fishery although the fishery has fluctuated in importance (in terms of recorded volume of production) compared with harvests of other species and populations. Thus for the period 1948-1955 harvest of Caribbean and Gulf of Mexico C. mydas appears to have been of greater importance (total recorded fresh meat production of 530 tonnes for Pacific C. mydas compared with 2020 tonnes from the eastern seabord of Mexico for 1948-55). From 1956 to 1963 Pacific C. mydas was the most important component of the Mexican Turtle fishery. Official live weight production of 3430 tonnes compared with 2245 tonnes from C. mydas from the eastern seabord and 1830 tonnes of

Table 144. Mexican production of turtle products 1948-73 (tonnes). Taken from Márquez (1976a). * Turtle fishery was officially closed in Mexico during 1972.

Year	'C. agassizi'				'C. mydas'				Eretmochelys
	Live wt equiv.	Dry meat	Leather	Oil	Live wt equiv.	Dry meat	Leather	Oil	Tortoiseshell
1948	40	0.7	-	0.05	260	-	-	-	-
1949	40	4.2	-	0.22	320	-	-	-	-
1950	120	6.8	-	1.33	380	-	-	0.30	-
1951	80	5.2	-	0.32	280	-	-	0.32	-
1952	30	4.7	-	0.13	290	-	-	0.13	-
1953	60	9.1	-	-	160	0.6	-	-	0.07
1954	70	9.3	-	0.33	160	-	-	-	2.83
1955	90	9.2	-	0.05	170	1.2	-	-	2.82
1956	170	5.3	-	?	80	-	-	-	0.14
1957	380	9.4	-	0.18	140	-	-	-	-
1958	330	15.2	-	0.09	60	-	-	-	-
1959	230	32.7	-	-	120	-	-	0.13	-
1960	380	44.3	-	-	510	1.5	-	-	-
1961	380	17.7	-	-	310	-	-	-	-
1962	520	9.5	-	1.69	330	-	-	0.20	-
1963	580	5.7	-	1.15	80	2.4	-	1.66	-
1964	520	33.2	-	0.11	160	-	-	0.28	0.14
1965	400	33.4	18	-	180	5.5	11	0.64	0.08
1966	580	11.8	16	0.07	60	-	4	0.34	0.04
1967	530	11.4	20	-	100	-	7	-	0.06
1968	1620	5.8	28	0.60	150	-	14	0.89	1.15
1969	1080	4.8	7	0.69	90	-	2	0.26	0.30
1970	750	0.2	13	0.40	80	-	5	0.04	0.20
1971	230	0.3	5	-	30	-	-	-	0.07
1972*	-	-	2	-	-	-	-	-	-
1973	490	?	-	-	40	-	-	-	4.87

Lepidochelys olivacea. The meat yield amounts to around 20-25% of the live weight. From 1964 onwards, the L. olivacea fishery has been by far the most important, and chiefly responsible for the enormous increase in turtle harvests in Mexico from 1965 to 1968: total official live weight harvest for 1964 to 1973 (excluding 1972 when the fishery was theoretically closed) amounted to 40 589 tonnes of L. olivacea compared with 6200 tonnes of Pacific C. mydas and only 890 tonnes of eastern C. mydas.

To convert these figures into estimates of the total numbers of turtles taken, estimates are needed for: (a) Mean weight of harvested turtles; (b) Proportion of turtle fishery unrecorded.

For (a), authors generally use 36.5 kg mean weight (taken from Caldwell's (1962b) measurements for turtles harvested in Baja California) though Suarez (no date) uses 38 kg. For (b), estimates are far more conjectural. Cliffton et al. (1981) citing Carr (1972) estimate that, for the late 1960s and early 1970s, fisheries statistics for Pacific Mexico record approximately one-third the total number of turtles landed. Using these

figures, and based on an official fresh meat production of c. 4600 tonnes for 1966-70, they estimate that during that period c. 375 000 Green Turtles were landed on the Pacific coast of Mexico, of which at least half were adults.

Suarez, however, quotes much larger figures for turtle harvests in the state of Michoacán (Table 145). Márquez (in litt., 29 August 1988) cautioned that these figures were probably inflated, Suarez having political reasons for exaggerating the illegal harvest, and that they refer principally to L. olivacea.

Table 145. Turtle harvests in Michoacán, 1965-77. *Fishery officially closed.

Year	Official Information		Unofficial information	
	No. taken	Weight (tonnes)	No. taken	Weight (tonnes)
1965	447	17	15 000	570
1966	26	1	15 000	570
1967	1447	55	25 000	950
1968	1526	58	30 000	1140
1969	684	26	5000	190
1970	474	18	5000	190
1971*	0	0	15 000	570
1972*	0	0	10 000	380
1973*	0	0	15 000	570
1974	987	37.5	10 000	380
1975	889	33.79	10 000	380
1976	1819	69.11	5000	190
1977	575	21.86	5000	190
Total	8874	337.26	165 000	6270

It is possible, however, that the estimates of Carr and Cliffton et al. are more accurate for Baja California and the Gulf of California (see below).

Overall it is certain that since the late 1950s many hundreds of thousands of Green Turtles, quite probably over one million, have been landed on the Pacific Coast of Mexico. This fishery will have been by far the most important factor in the collapse of turtle populations, both nesting and feeding and overwintering, on this coast which took place during the 1970s.

Márquez (1976a) does not provide a state-by-state breakdown of fisheries; discussions of the relative importance of different regions in the turtle fishery are derived from other sources and are necessarily more anecdotal:

i. Northern Mexico and Baja California

As the USA market for turtle meat dwindled in the 1920s, demand increased in the Mexican border towns of Tijuana, Mexicali and Nogales and in the major cities in Baja California and Sonora.

Parsons (1962) reported that in the 1950s substantial numbers of Green Turtles were taken by Baja Californian fishermen on both sides of the

peninsula. It seems almost certain that most, if not all, officially recorded Pacific Green Turtle harvest in Mexico at that time took place here. Parsons quotes official production figures for 1956 of some 17 000 kg of fresh turtle and 5300 kg of dried turtle produced by Baja California fishery cooperatives, most coming from the southern part of the peninsula; the latter figure accords exactly with that given in Márquez (1976a), the former disagrees by exactly a factor of ten, with Parsons almost certainly in error. Most were taken north in trucks to the border towns although others were flown from Laguna Ojo de Liebre and Bahía Magdalena. A turtle cannery operated at this time in Bahía de Asunción south of Laguna Ojo de Liebre which canned up to 100 tons of Green Turtle soup in a season, virtually all marketed on the peninsula; the turtles were taken in the summer months using nets set in lagoons and estuaries along this coast.

Caldwell (1963) stated that by then most Green Turtles landed in Baja California were taken in the central and southern Gulf of California, although commercial fishing evidently continued on the west coast of the peninsula - he noted that turtles were still commercially taken as far north as Bahía de San Quintín (c. 30°15'N) on the west coast and also in Bahía Magdalena where a turtle cannery apparently existed at the time of writing. Turtle harvest at this time was considerable and Caldwell stated that, for example, several thousand were landed each year in Bahía de los Angeles on the central Gulf coast of Baja California. He observed over 500 landed in a three-week period in summer (June-July) 1962 and just under 290 taken in February of that year when fishing effort was lower. He stated that, along with tourism, the turtle fishery formed the economy of the area and noted that in other villages in the region the turtle fishery often formed the sole source of income.

ii. Michoacán

Prior to the 1950s the coastal breeding sites of C. mydas were relatively undisturbed as the coastline was virtually uninhabited and of difficult access. The only recorded egg harvest appears to have been that by the Nahuatl Indians who lived slightly further inland, on the Pacific slopes of the Sierra Madre del Sur, where their main population centres were Pomaro, Coire, Maquili and Ostula. From here sporadic trips were made to the nesting beaches during the peak of the turtle nesting season to collect eggs. These were transported by mule and donkey to the villages where they were eaten fresh or hard-boiled and dried to supplement their otherwise largely vegetarian diet.

During the 1950s coastal areas were increasingly cleared, mainly for the planting of coconut palms and banana and lime trees, and during the late 1950s the coastal settlements of Maruata, Colola and Motin del Oro were established. Access to the area remained difficult by land (a road to Maruata was not built until 1978) and at this time use of turtles in the area appears to have been still relatively low-level subsistence (apparently still very largely, or perhaps exclusively, eggs). During the late 1960s commercial markets for sea turtle products opened up in the region, involving both leather and eggs. Eggs were apparently exploited very largely by the Nahuatl themselves, and settlements around the nesting beaches increased rapidly. Most egg collection was carried out by the inhabitants of Colola who, according to Alvarado (in litt. to C. Freese, 12 July 1985), derived 90% of their income from the sale of eggs. Cliffton et al. (1981) quote Nahauatl informants as claiming that during the early 1970s 70 000 eggs were collected each night of the breeding season at Colola during the breeding season and a further 15 000-20 000 from Maruata Bay,

although Alvarado and Figueroa (1986) state that the total collected at Colola at this time was nearer 40 000 eggs per night.

Until the end of 1963 processing of turtle leather in Mexico was on a local, artisanal, level. During 1964 with the increase in international demand for the product, larger scale, industrial processing began (Márquez, 1976a). The international market for turtle leather was initially filled mainly by exploitation of Lepidochelys olivacea, whose leather is considered of higher quality; however, by the end of the 1960s this species had been seriously depleted and attention was turned to Chelonia mydas. At first harvesting was carried out by fishermen from the nearby states of Colima, Jalisco and Guerrero and was, reportedly, obstructed by the Nahuatl who saw it as conflicting with their own commercial interests based on egg collecting. Soon, however, the Nahuatl had themselves begun harvesting turtles, using nets placed directly off the nesting beaches (Cliffton et al., 1981).

Until the mid-1970s the turtles were apparently harvested exclusively for their skins. Cliffton et al. note that during 1976 turtles netted off the nesting beaches were stripped of their hides, which were sold for 50 pesos (US$2.20) each, and the carcases were thrown into the sea. The hides were transported by boat to the coast of Colima. In 1977 the Industria Pesqueria Occidental (IPOSA) began full-scale processing of legally taken turtles at a plant in Barra de Navidad. Hides and meat appear to have been the principal products, with bones, entrails and carapaces turned into chicken feed. Figures for C. mydas harvest in Michoacán for 1965-77 are given in Table 145 above. As noted above, Márquez (in litt., 29 August 1988) considers these data unreliable. According to Márquez (in litt.) IPOSA was harvesting L. olivacea nearly exclusively, not C. mydas, and catch permits were only for the former species, not the latter. Márques also states that much of the information presented by Cliffton et al., cited in this account, must refer to L. olivacea.

In 1978 a new coastal highway reached the area, passing within 200 m of the main nesting beaches; smugglers from the northen states of Sinaloa and Sonora gained easy access to the Michoacán turtles and began offering higher prices than IPOSA. Since then most poached turtles have been smuggled to the north for meat consumption (Alvarado and Figueroa, 1986).

Domestic trade Chelonia mydas meat is predominanty consumed in northern Mexico (see above), where it is of high commercial value (in 1979 costed at 100 pesos or US$4.44 a kg live weight, which was higher than the cost of beef). Eggs are also sold in large numbers in Mexican cities.

International trade As discussed at length above, turtle meat in many forms (live, fresh, salted, dried, calipee) has in the past been exported in considerable quantity from Mexico, although it appears that since at least the 1940s virtually all meat produced has been consumed in Mexico itself. Annual reports to CITES note trivial amounts of meat and soup exported (mainly to the USA and most classified as illegal or personal) since 1977. Mexico has produced some tortoiseshell, although production has been erratic (see Table 144) and there is no evidence of any large scale exports since the early 1970s - Japan, which has been by far the largest consumer of tortoiseshell in recent years, records imports from Mexico of only 44 kg in the years 1972-86 inclusive (8 kg in 1973, 36 kg in 1983). Table 146 summarises exports of Eretmochelys recorded in annual reports to CITES for 1978-85. Leather items, oil and eggs are excluded as there is considerable uncertainty that these are indeed Eretmochelys (in the case of the last two, the amounts involved are trivial, and in the case of leather items are

almost certainly mostly Lepidochelys olivacea - see below); all remaining items were exports to the USA.

Table 146. Exports from Mexico to USA of items classified as Eretmochelys recorded in CITES statistics, 1978-85 (excluding leather and eggs). "Bodies" includes shells, skulls and trophies; "Items" are virtually all carvings and unspecified.

Year	1978	1979	1980	1981	1982	1983	1984	1985
Bodies	-	-	65	59	38	24	12	-
Items			473	244	35	41	6	-

By far the most important exports from Mexico recorded in CITES statistics are skin or leather items. The great majority of these are to Italy and are recorded either as re-exports from Italy (with origin Mexico) of worked items or as imports to Italy (reported by Italy) of skins from Mexico. Although such skins are recorded under "Cheloniidae", "Chelonia mydas" or "Eretmochelys imbricata" it seems very likely that a high proportion were in fact Lepidochelys olivacea. The skins of this taxon are generally preferred, being considered of higher quality (Cliffton et al., 1981). Italy, however, took out a CITES reservation on C. mydas (31 December 1979, withdrawn 1 January 1984) but not on Lepidochelys, thus to admit export of the latter would be to admit contravention of CITES regulations. Márquez (in litt.) stated that nearly all the skins and items in reported trade (see Table 147) are derived from L. olivacea.

Table 147. Leather items and skins classified as C. mydas or Eretmochelys imported by Italy from Mexico or exported by Italy with origin Mexico recorded in annual reports to CITES, 1978-85. Márquez (in litt.) stated that virtually all so-called "C. mydas" products below were actually derived from Lepidochelys olivacea.

	1979	1980	1981	1982	1983	1984	1985
C. mydas							
Skins	3153	14 696	10 500	472	-	-	-
Items	2693	11 048	17 085	4072	928	17	-
Eretmochelys							
Skins	-	-	-	-	-	-	-
Items	-	316	2760	251	12	-	-

All "Items" above are recorded as re-exports by Italy to a number of countries (pairs of shoes are counted as one item).

In addition, Mexico in 1979 exported 1250 skins of C. mydas to Hong Kong and apparently re-exported 5770 skins origin Cayman Islands (4020 to the USA and 1750 to Hong Kong); in 1981-83 Mexico re-exported a total of 4504 skins

origin Cayman Islands to Hongkong (2500 in 1981, 1887 in 1982 and 1816 in 1983).

All other exports recorded by CITES are trivial by comparison. It is evident that these figures cannot be used as a reliable guide for trade in C. mydas or Eretmochelys from Mexico. It does however appear as if declared trade in turtle products in general from Mexico has decreased considerably since the early 1980s.

LEGISLATION

Rules relating to the taking, utilisation and marketing of sea turtles (September 1968).

Regulates the commercial exploitation of sea turtles and establishes minimum sizes. The exploitation of and trade in turtle eggs is prohibited. Close season established. The Directorate of Fisheries is empowered to modify close season, to close certain areas to turtle taking and to limit the number of animals taken. Turtles taken by shrimp boats must be landed alive. The domestic trade in turtle skins and other products is regulated.

C. caretta
C. mydas
E. imbricata
D. coriacea

Ley de Desarrollo Pesquero 25 May 1972.

Authorises adoption of season and other regulations for the taking and exploitation of sea turtles.

Annual Fisheries Regulations.

Taking of sea turtles is prohibited on both coasts with the exception of L. olivacea for which limited quotas are set.

Commercial exploitation of any sea turtle species has been prohibited since 1983 in the Mexican Caribbean and Gulf (Márquez in litt., 29 August 1988).

POPULATION: Chelonia mydas

Nesting sites Jeffers and Meylan (1984) reported possible nesting at Yellow Hole, Bunkum Bay and Limekiln Bay. Meylan (1983) noted the belief of some local residents that Green Turtles nested on the island but could find no evidence of recent nesting. Bacon (1971, cited in Meylan, 1983) reported nesting by Green Turtles at Little Bay and Isles Bay.

Nesting numbers According to Meylan (1983) there was little nesting by sea turtles on Montserrat.

Foraging sites Jeffers and Meylan (1984) noted foraging at O'Garro's, Bransby Point, Bunkum Bay and Trant's Bay. Green Turtles were relatively common year round residents, particularly off the lower south-western coast (Meylan, 1983).

POPULATION: Eretemochelys imbricata

Nesting sites Jeffers and Meylan (1984) reported nesting at Farm Bay, Yellow Hole, Rendezvous Bay, Little Bay, Carr's Bay, Bunkum Bay, Woodlands Bay, Limekiln Bay, Old Road Bay and Fox's Bay. Bacon (1971, cited in Meylan, 1983) noted nesting at Isles Bay.

Nesting numbers Meylan (1983) considered that the incidental nesting which occurred on Montserrat could mostly be attributed to Hawksbills.

Foraging sites Jeffers and Meylan (1984) reported foraging at O'Garra's, Bransby Point, Rendezvous Bluff, Yellow Hole, and Trant's Bay. Meylan (1983) noted the relatively common year round presence of Hawksbills around Montserrat, particularly off the lower south-western coast.

EXPLOITATION

Commodity The main commodities were meat, that of the Green Turtle being preferred (Meylan, 1983), and shell products, including polished carapaces of Green Turtles and Hawksbills and tortoiseshell jewellery (Jeffers and Meylan, 1984). Meylan (1983) also noted the production of turtle oil.

Hunting intensity Information is limited. Rebel (1974, cited in Meylan, 1983) reported 16 nets to be in use in 1948 and that, during that year, 70 turtles were landed at Plymouth. Jeffers and Meylan (1984) noted landing sites, for Green Turtles and Hawksbills, at Plymouth, Carr's Bay, Bunkum Bay, Sugar Bay, and Farm Bay; and also stated that four or five turtle nets were still in use.

Hunting methods Jeffers and Meylan (1984) reported the use of spearguns and nets. Meylan (1983) noted that netting was used, to a limited extent, in the northern part of the island.

Historical trends According to Rebel (1974, cited in Meylan, 1983), the government had apparently discouraged hunting by buying nets from fishermen. Only a few fishermen still knew how to make nets and the shortage had become a limiting factor. Meylan (1983) noted that turtles were being caught to an increasing extent by young divers using spearguns.

Domestic trade Jeffers and Meylan (1984) reported the sale, as souvenirs in local shops, of polished Green Turtle and Hawksbill carapaces and tortoiseshell jewellery.

Meylan (1983) noted other aspects of domestic trade. Turtle meat was usually sold privately, although, during the open season, it could be found at the public market and in restaurants in Plymouth. There was an active trade in turtle curio and almost all the tourist shops in Plymouth, and even some bars, were selling polished Green Turtle and Hawksbill carapaces. Most of the shells for sale were from juvenile or sub-adults; the carapace of an 84-cm Hawksbill was priced at US$74 in 1980. By 1983, however, this trade had declined, possibly due to the United States' ban on importation of turtle products. Some tortoiseshell was worked locally, selling for US$13 a/kg in 1980. Prisoners at the jail were employed making tortoiseshell jewellery to be sold in local shops.

International trade There appears to be very little international trade involving turtles products from Montserrat. There are no reports on any trade in the Cites Annual Reports (Montserrat is covered by the United Kingdom Ratification of CITES). Rebel (1974, cited in Meylan, 1983) reported the export of 45.5 kg of tortoiseshell, and that one fisherman reported exporting small quantities of turtle oil to St Kitts.

LEGISLATION

Turtle Ordinance 24 September 1951

Close season 1 June to 30 September inclusive. The taking of any turtle under 20 lb (9 kg) is prohibited. It is prohibited to slaughter, buy, sell, possess turtles or their eggs or meat between 1 June to 30 September inclusive.

MOZAMBIQUE

POPULATION: Chelonia mydas

Nesting sites There appears to be limited nesting on the northern sector of the mainland coast, but most nesting (according to local information and some photographic evidence) takes place on the Primeiras group of islands, some 25 km offshore between Moma and Pebane (Hughes, 1971a). The Primeiras comprise five low sand islands, surrounded by coral shallows; reportedly Fogo, Casuarina and Epidendron are the most important for nesting (Hughes, 1971a). Hughes (1971b and 1976) implies that nesting also occurs in the Segundoes group, just north of the Primeiras. Some nesting was also reported to occur on islands north of Porto Amelia, toward the border with Tanzania, and may occur on two islands (Paradise Islands) off the tip of Cape San Sebastian, in southern Mozambique (Hughes, 1971a).

Nesting numbers Few details are available, but Hughes (1971a) was assured that large numbers nested on the Primeiras; it was reportedly possible to fill a 200-litre drum with eggs collected in less than half an hour. Hughes (1971a) stated that this group is almost certainly the most important nest site in Mozambique, and the source of the majority of the foraging C. mydas found in relative abundance in the country's coastal waters. Hughes (1974) estimated the annual Primeiras nesting population at around 50-200 females and later (1976) estimated around 200 on the Primeiras and Segundoes combined.

Trends in nesting numbers No long-term data are available. Hughes (1971a) indicated that nesting and feeding C. mydas are threatened by exploitation, which appears to be widespread and persistent; this has led to marked decline in turtle nesting in many regions, including a rapid decline in turtles nesting on some of the islands in the north (species involved not stated but may be presumed to include C. mydas).

Nesting season It is suspected (Hughes, 1971a) that turtles in the area generally nest during December-February, in the southern hemisphere summer.

Foraging sites Suitable foraging grounds are widespread; nearly all bays and inlets support seagrass pastures; coral reefs and shallows are extensive (Hughes, 1971a). Feeding turtles appear to occur in greatest numbers over the seagrass pastures in northern areas and, toward the south, around the Paradise Islands (I. do Barzaruto, I. Benguerua) and adjacent mainland (around Inhassora). In general, C. mydas occur throughout the coastal waters of Mozambique, but juveniles were said by Hughes (1971a) to be extremely numerous. A Chinese fishing community at Inhassora, using nets, catch juveniles far in excess of adult C. mydas or other species (Hughes, 1971a).

Migration Little information is available. It may be suspected, given the small size of the known nesting population in Mozambique, and the abundance of foraging C. mydas along the coast (in 1969-1970; Hughes, 1971a), that a substantial proportion of the species's total population in the country nests elsewhere. Europa Island is the nearest major nest site, but to date only one female tagged on Europa has been recovered in Mozambique waters, near Maputo (Hughes, 1982b).

POPULATION: Eretmochelys imbricata

Nesting sites Nesting is reported to occur on offshore islands in northern Mozambique, from Moma northward, including in particular Quirimba,

Singar and Mefunvo, near Ibo, north of Porto Amelia (Hughes, 1971a). Hughes (1976) implies that nesting also occurs in the Primeiras.

Nesting numbers No information is available on the nesting population; the species in general appears to be relatively common, particularly in the north of the country (Hughes, 1971a).

Trends in nesting numbers No information is available. Hughes (1971a) stated that hunting pressure at the time of his writing was light, and was likely to be having little negative effect on E. imbricata populations.

Foraging sites No site-specific information is available, but numbers appear to be concentrated over the extensive coral reef shallows in the north, from Angoche onward (Hughes, 1971a).

EXPLOITATION

Commodity All species of turtle are exploited for meat and eggs in Mozambique. The Green Turtle is by far the most eagerly sought after but the flesh of Hawksbills is also popular. There is no record of poisoning in the country. In the north, the entire coastal population is Moslem, and is theoretically forbidden by religious law to eat turtles; however, most of the fishermen questioned admitted regular contravention of this custom. Hawksbill shell is widely used to make curios for the tourist and export trade. Green Turtle shell is not generally used, although juveniles are occasionally stuffed. In central Mozambique, the heart of a turtle is thought to have the ability to prolong life because of its tendency to carry on beating after the animal has been killed (Hughes, 1971a).

Hunting intensity There is an extensive harvest of turtles in the calm coral lagoons along the coast. The magnitude of the harvest of C. mydas is not known, as nearly all are consumed locally. The export trade in Hawksbill shell was thought to represent a harvest of about 200 a year, and not, on its own, to represent a serious threat to the turtle population (Hughes, 1971a).

Turtle nests are said to be collected whenever they are found by African women. On the Primeiras Islands, a major nesting site for C. mydas, the filling of 200-litre drums with turtle eggs (see above) indicates that egg collection is a major, if not organised, activity. Frazier (1980a) asserted that egg exploitation was greater on the mainland than on the Primeiras Islands. The exploitation pressure on turtles in the north of the country is thought to be less, because the fish catch is greater there (Hughes, 1971a).

Hunting methods The Southern African people are not fishermen by tradition, and there is little deliberate fishing for turtles, most of the catch being fortuitous. Killing of turtles on the nesting beaches is one of the major methods of capture (Hughes, 1971a).

Historical trends Zanzibar has imported tortoiseshell from Mozambique since at least 1890, and traded regularly (about 300 kg a year) from 1920 to 1964 (Frazier, 1980a). There is no historical information on the levels of subsistence harvest.

Domestic trade Most of the Green Turtles caught are consumed by the fishermen, but at Pemba (Porto Amelia) the meat is occasionally sold in the

market for about $8 a kg (US$0.34). At Inhassoro, juvenile C. mydas are caught by the community of Chinese fishermen, and many are prepared and sold as curios to tourists (Hughes, 1971a).

The value of Hawksbill shell is widely appreciated, and it is either used by local artisans for making tourist items or sold by fishermen at about US$1.30-4.30 a kg and then on to European importers at US$9.00 a kg (Frazier, 1980a). Polished shells of juveniles were said to sell for $20 (US$0.85) (Hughes, 1971a).

International trade Most of the export trade is believed to be centred on Mozambique Island, where a trader was said to have agents in several ports, buying shell from the fishermen. About 600-1000 kg of shell was said to be exported a year, mainly to Italy and France (Hughes, 1971a).

The Customs reports consulted have not contained any reference to trade in tortoiseshell with Mozambique since 1977. Prior to that, Singapore, Japan and Italy reported small quantities in their import statistics (see Table 148). CITES Annual Reports have indicated no trade in turtle products with Mozambique.

Table 148. Imports of tortoiseshell from Mozambique reported in the Customs statistics of importing countries. All quantities in kg (from Wells, 1979).

	1973	1974	1975	1976	1977
Italy	-	101	100	186	0
Japan (Bekko)	452	0	0	277	0
Singapore	435	120	0	0	290

LEGISLATION

Hunting Regulations (Portaria 117/78), 16 May 1978.
Prohibits possession of and trade in sea turtles.

While *C. mydas* is known to enter Namibian waters, nesting is considered unlikely, and has never been confirmed (Hughes, 1982). No records of *E. imbricata* in Namibia appear to exist, although Carvalho (1986, *in litt.*) suggests that the species may occur.

CITES Annual Reports contain no record of trade in turtle products with Namibia, but Namibia is administered from South Africa and does not submit a separate CITES report.

NAURU

No information on sea turtles is available. Although the island has sand beaches and coral reefs, intense development of the island in connection with phosphate mining suggests that turtle nesting is likely to be non-existent or insignificant.

Nauru is not a Party to CITES and CITES Annual Reports contain no record of any trade in sea turtle products involving Nauru. Fijian Customs reports indicate the import of a small quantity of worked tortoiseshell from Nauru in 1978.

NETHERLANDS ANTILLES: CURACAO AND BONAIRE

POPULATION: Chelonia mydas

Nesting sites Former nesting sites on Bonaire include Playa Chikitu, Lagoen, Lac, Witte Pan, Sorobon, Saliña and Playa Grandi. Sybesma (1987b) considered that no nesting occurred on Curaçao.

Nesting numbers There is thought to be no nesting on Curaçao and there are no recent records for Bonaire (Sybesma, 1987b).

Trends in nesting numbers Nesting appears to have ceased on Bonaire (Sybesma, 1987b).

Foraging sites Van Buurt (1984) reported foraging along the north coast and East Point Bay on Curaçao, and along the north and east coasts and at Lac Bay on Bonaire. Sybesma (1987b) noted that a lot of turtles are seen in the sargassum off the north-west coast of Curaçao and in the sargassum and seagrass at Lac Bay, Bonaire.

POPULATION: Eretmochelys imbricata

Nesting sites Van Buurt (1984) reported nesting on Klein Bonaire, at Washikemba, Sorobon, Saliña and Playa Grandi on Bonaire and at Knip beach on Curaçao, and possible nesting on Klein Curaçao and at East Point Bay on Curaçao. Sybesma (1987b) considered that nesting has ceased on Curaçao and Bonaire.

Nesting season Nesting recorded by van Buurt (1984) occurred from June to September on Klein Bonaire, from June to July or September at Washikemba on Bonaire, and from July to November on Klein Curaçao.

Foraging sites Van Buurt (1984) reported that E. imbricata forage along the north coast and at East Point Bay on Curaçao and along the north and east coasts and at Lac Bay on Bonaire. They are said to be moderately abundant all around Bonaire (Sybesma, 1987b).

EXPLOITATION

Commodity Income is derived from the sale of shell and meat but there is no demand for eggs (Sybesma, 1986).

Hunting intensity Van Buurt (1984) reported the landing of 200 turtles per year at Lac Bay and Kralendijk on Bonaire; most of these were Green Turtles and it was noted that some of them came from Aves Island and Los Roques. Sybesma (1987b) considered that this was a rare event and reported that about 250 turtles a year (50/50, E. imbricata/C. mydas) were caught off Bonaire. The local catch at Curaçao was said to be no more than 40 a year, but turtles are also bought from Venezuelan fishermen. According to one dealer on Curaçao, fishermen catch turtles regularly, mostly in the eastern part of the island and in St Joris Bay, and can supply up to 5-6 turtles a day if necessary (Sybesma, 1986).

NETHERLANDS ANTILLES

Hunting methods Beach seine nets are used in Lac Bay and harpoons are used in the open sea (van Buurt, 1984). Sybesma (1987b) mentioned the use of gill nets from June to December, the sea being too rough at other times.

Historical trends The total catch at Bonaire is not thought to have declined much, but the size of turtles caught is said to have decreased markedly.

Domestic trade There is said to be very little demand for sea turtles in Curaçao, although three restaurants serve turtle meat and soup. Turtles can be obtained to order at the local market. The shells fetch NaF15 each for small ones and NaF25 for larger ones; meat is about NaF10-20 a kg, about half being C. mydas and half E. imbricata (Sybesma, 1986). Turtle meat is more popular on Bonaire and is sold locally in restaurants though there is little trade in souvenirs.

International trade The Netherlands Antilles are not covered by the Dutch ratification of CITES. Aspects of the international trade are discussed in the section on the Leeward Islands.

The chief international trade in turtles appears to involve the landing of live turtles by Venezuelan fishing boats. Sale of turtle meat is prohibited on the Venezuelan mainland but not in the Netherlands Antilles (J. Sybesma in litt., 30 March 1987).

LEGISLATION

Bonaire: Eilandsverordening 29 June 1961, Protection of marine turtles and lobsters.
All turtle nests and eggs are protected.

Bonaire: Eilandsverordening 1971.
All spearfishing is prohibited.

Curaçao: Eilandsverordening 22 September 1976, Management of the marine environment.
All spearfishing is prohibited.

NETHERLANDS ANTILLES: SABA, ST EUSTATIUS, ST MAARTEN

POPULATION: Chelonia mydas

Nesting sites **Saba:** Saba has virtually no permanent beaches and Meylan (1983) considered it difficult to imagine anything but the most "desultory" nesting on the seasonally deposited beaches. Nevertheless, Meylan (1983) reported residents' insistence that Green Turtles nested on rare occasions at Cave of Rum Bay, Well Bay and Fort Bay.
St Eustatius: Van Buurt (1984b) reported nesting at Concordia Bay. According to Meylan (1983), Green Turtles were reported to nest on rare occasions at Zeelandia, in Concordia Bay. The south coast was said to be unsuitable for nesting, the best sites being on the Atlantic coast (Sybesma, 1987a).
St Maarten: Green Turtles nested at Guana Bay and Oyster Pond on the windward coast of the Dutch part of the island (Meylan, 1983).

Nesting numbers Meylan (1983) reported the frequency of nesting by all species on St Maarten to be "quite low"; few turtles of any species to be nesting on St Eustatius; and the number of turtles nesting on Saba to be undoubtedly very small. Sybesma (1987b) considered that there was no longer any nesting on St Maarten, none on Saba and little, if any, on St Eustatius.

Trends in nesting numbers Van Buurt (1984b) recorded an informant's report that turtle nesting had declined in recent years on St Eustatius. According to Meylan (1983), turtles on Saba were said to be "not so plentiful now".

Nesting season Almost no information. Nesting reported on St Eustatius by van Buurt (1984b) occurred in July and August.

Foraging sites **Saba:** Van Buurt (1984b) reported foraging in a 50 km sq. area on the north-east of Saba Bank. Meylan (1983) noted favourite netting locations of the past, and thus presumably good foraging areas for Green Turtles at Fort Bay, Cove Bay and Green Island. Local scuba divers reported seeing Green Turtles around Green Island, to the north of Corner Point and along the south coast between Giles Quarter and Tent Bay (Meylan, 1983); however, out of 17 turtles seen in 1986, only two were C. mydas (Sybesma, 1986).
St Eustatius: According to van Buurt (1984b), foraging occurred at Tumbledown Dick, Jenkins Bay, and Whitewall. Meylan (1983) noted that twenty years ago, Orangestad Bay, Jenkins Bay and Whitewall were preferred netting locations, and were thus presumably foraging sites.
St Maarten: Sybesma (1987a) reported that they were seen often and were the most common turtles. Meylan (1983) noted that in former times Green Turtles could be seen foraging in the harbour at Philipsburg but that they were now rarely sighted.

POPULATION: Eretmochelys imbricata

Nesting sites **Saba:** Van Buurt (1984b) reported nesting at Cave of Rum Bay, Well Bay and Fort Bay. (But see comments under C. mydas)
St Eustatius: Nesting was reported at Concordia Bay by van Buurt (1984b). Meylan (1983) reported Hawksbills nesting on rare occasions at Zeelandia, in Concordia Bay and single reports of Hawksbills nesting at Nap, Corre

Bay, Kay Bay and Crook Bay, although these were not confirmed by other interviews.
St Maarten: Meylan (1983) reported nesting at Guana Bay and Oyster Pond on the windward coast of the Dutch part of the island. Sybesma (1987b) recorded no recent nesting.

Nesting numbers According to Meylan (1983), the number of turtles nesting on Saba was undoubtedly very small; few turtles of any species nested on St Eustatius; and the frequency of nesting by all species on St Maarten was "quite low".

Trends in nesting numbers Turtles on Saba were considered to be "not so plentiful now", Hawksbills being thought to be particularly scarce.
According to van Buurt (1984b), informants reported a decline in turtle nesting in recent years on St Eustatius.

Foraging sites **Saba:** Meylan (1983) presumed, from previous netting locations, foraging sites to be located at Fort Bay, Cove Bay and Green Island. Meylan (1983) also noted reports by local scuba divers of Hawksbills foraging at Green Island and on the reef at Core Gut Bay. Hawksbills were the most common turtle species seen by divers in 1986 (Sybesma, 1986), though not in 1987 (Sybesma, 1987a).
St Eustatius: Van Buurt (1984b) reported foraging at Tumbledown Dick and Jenkins Bay. According to Meylan (1983), scuba divers saw Hawksbills of all sizes on the reefs around the island and off the south coast near White Wall. Meylan (1983) also reported the use of nets, twenty years ago, to catch sea turtles at Orangestad Bay, Jenkins Bay and White Wall.
St Maarten: Meylan (1983) reported Hawksbills foraging in reef habitats along the east coast of the island, especially off Oyster Pond, and also at Pelican City, Molly Beday and Man o' War Shoal.

THREATS

The beaches of St Maarten are subject to considerable tourist development and successful turtle nesting would be most unlikely. Saba and St Eustatius are less affected (Sybesma, 1987a).

EXPLOITATION

Commodity Turtle meat was popular amongst Sabans, and on St Maarten, souvenirs were made from turtles, and turtle steaks were eaten in restaurants (Meylan, 1983).

Hunting intensity **Saba:** Meylan (1983) reported finding no net fishermen in 1980, but noted the popularity of spearfishing amongst members of scuba clubs. Club members estimated that only 10-20 turtles were killed annually with spearguns, but Meylan (1983) thought it likely that the catch exceeded this. Sybesma (1987b) reported that the three full-time fishermen catch a small number of turtles for their own consumption.
St Eustatius: According to Meylan (1983), there appeared to be less pressure from exploitation than elsewhere in the region. Netting was not practised on the island and had not been for several years. Although turtles were captured by spearfishermen, the usual markets for curios and turtle meat did not exist owing to the limited nature of tourism on the island and the catch was consequently small. This was confirmed by Sybesma (1987a).

St Maarten: Spearfishing was commonly practised and a few fishermen from St Maarten and from neighbouring islands set nets around St Maarten (Meylan, 1983).

Hunting methods Meylan (1983) described hunting methods on the three islands:
Saba: The practice of fishing for turtles with nets had apparently died out and had been replaced by spearfishing. Spearfishing was very popular, especially among members of the scuba clubs. Large turtles were captured by use of a long line and a float attached to the spear to allow pursuit of the turtle by boat, once the spear was well-lodged.
St Eustatius: Turtle nets were no longer set by islanders. Turtles were captured by spearfishermen and were taken on the nesting beaches whenever they were encountered. Unknown numbers were taken by net fishermen and divers from other islands.
St Maarten: Tangle nest were used by a few local fishermen and nets were set by fishermen from other islands, notably St Barthélemy. Spearfishing was commonly practised, as was the taking of turtles and eggs on the nesting beaches.

Historical trends **Saba:** Meylan (1983) noted the more prominent role turtles once had in the island's culture. In the early part of the century, Sabans used to sail by schooner to Aves Island to harvest Green Turtles. Men were left on Aves for two-week periods to turn turtles as they emerged to nest. The ship then returned to transport the men and their catch of as many as 50 turtles back to Saba. A small number of men had customarily been involved in setting turtle nets in Saban waters; in 1940 there were four turtlers operating out of The Bottom.
St Eustatius: Turtle nets had not been set for some years (Meylan, 1983).
St Maarten: No information.

Domestic trade Meylan (1983) discussed domestic trade on the three islands:
Saba: The souvenir trade was small in magnitude owing to the small number of shops and tourists. One craft shop in Windwardside was offering for sale the shells of five Hawksbills and two Green Turtles. There was no evidence of trade in tortoiseshell, presumably because of the small number of Hawksbills captured.
St Eustatius: Tourism was relatively undeveloped and the usual markets for curios and turtle meat did not exist.
St Maarten: Although some turtles were captured for local sale, the greatest pressure exerted on the turtle populations was by the tourist industry. Souvenirs made from turtles, and turtle steaks for restaurants were in great demand. There was also an active trade in tortoiseshell. In 1980, one dealer from St Maarten was buying shell from several islands in the northern Leewards, yet despite offering a high price of US$100/kg, he was able to purchase less than half as much shell as formerly, presumably because Hawksbill populations had been so badly depleted. Sybesma (1987a) reported that there was little trade in either turtle meat or shell products.

International trade The Netherlands Antilles are not covered by the Dutch ratification of CITES, nor are they included in the EEC. There appears to be very little international trade in turtles or turtle products from the Netherlands Antilles. CITES annual reports for the period 1977-1985 record the import to the USA from the Netherlands Antilles of one _E. imbricata_ shell in 1984; and the export to the Netherlands Antilles from the Cayman Islands of 48 pieces/derivatives of _C. mydas_ in 1980.

NETHERLANDS ANTILLES

Japanese Customs reports indicate the import of 68 kg of bekko from the Netherlands Antilles in 1968 and none in other years between 1950 and 1986. The exact origin of these exports is not known. They could have originated either from the Leeward Netherlands Antilles discussed here or from Aruba, Curaçao or Bonaire (discussed separately).

Meylan (1983) noted the activities of a tortoiseshell dealer on St Maarten who was buying shell from several islands in the northern Leewards for export to Holland. Export records from the Dominican Republic show the export to "Saint Marteen" of 40 kg of turtles in 1982 (Ottenwalder, 1987b).

LEGISLATION

There are no island regulations protecting marine turtles on St Maarten or St Eustatius.

Saba: Island Reef Management Ordinance, 1987

Turtles may only be caught by island residents, up to a limit of two per person per year.

Female turtles may not be caught during the period April-November. All turtles caught must be reported to the Saba Marine Park Authorities.

It is forbidden to collect turtle eggs or disturb nests.

POPULATION: Chelonia mydas

Nesting sites Major nesting occurs on the four islands of the d'Entrecasteaux Reef system situated north of the main island of New Caledonia (Grand Terre): Surprise (in the south), Fabre, Leleixour, and Huon (in the north). Some nesting, apparently low intensity, occurs around Belep Island (north of Grand Terre, but within its reef system), and on the Loyalty Islands (east of Grand Terre), primarily on Beautemps-Beaupré but with some also on Lifou Atoll and perhaps on Ouvea. There appears to be very little, if any, nesting on the main island of New Caledonia); most turtle nesting here and in parts of the Loyalty group is by Caretta caretta (Pritchard, 1987a).

Nesting numbers Almost the only quantitative data available were collected by personnel of a French Navy vessel which visited Huon on 10-11 February 1980. According to their report (Anon, 1980, cited in Pritchard, 1987a) some 20 ha of the island (about 3 km long by 200 m wide) were used for nesting, within which one 50 x 50 m sample area contained approximately 140 nest pits, about one quarter of these estimated to be 48 hours old or younger. Hatchlings were emerging in abundance at this time, suggesting major nesting around December. Fresh tracks were distributed around the 6 km perimeter of the island at a density of 25 per 100 metres. Pritchard (1987) calculates that these figures represent some 1500 emergences or 2800 nests; one 4-hour observation period during one night, however, revealed about 50 nesting emergences. This suggests that the nest pits and tracks previously recorded were made over a period longer than 48 hours. Pritchard and others had flown over the d'Entrecasteaux Reef complex in December 1979 and seen signs that large numbers nest on all four islands, with beaches and dunes covered with tracks and pits, and the islands having "the appearance of being nested to capacity" (Pritchard, 1987a). Informants on Belep confirmed that very large numbers nest on the d'Entrecasteaux Reef Islands, one stating that he had once seen 200 turtles ashore (apparently on Huon) between 8 p.m. and midnight, and nesting density is such that females often destroy each other's nests (Pritchard, 1987a). Richer de Forges and Bargibaut (1985) recorded only 11 fresh tracks on Huon and two on Surprise during a brief visit at the end of February 1985; on Huon many hatchlings were emerging, indicating nesting in late December.

Pritchard (1987) noted that the numerical observations made on Huon in mid-February 1980 (50 nesting emergences in four hours) and late February 1985 (eleven nests a night) were at the end of the nesting season, and found no cause to doubt the report from Belep that 200 nested one night on Huon in December, seemingly around the peak nesting period. Substantial numbers also nest on the remaining islands of the d'Entrecasteaux area, but Huon apparently supports most nesting. On this basis, New Caledonia appears to hold the largest nesting C. mydas population of the oceanic Pacific, comparable to the more dispersed Chelonia population of the Galapagos, but greatly exceeded by those of the Great Barrier Reef islands in Queensland. Nesting elsewhere in New Caledonia appears to be sparse, with the possible exception of Beautemps-Beaupré in the Loyalty group, where moderate numbers may be involved.

Trends in nesting numbers Information is sparse; however, there is no evidence of overall decline in New Caledonia sea turtle populations, perhaps due largely to the remoteness of the main C. mydas nest beaches, the relatively intact tribal cultures in the areas with most turtles, and the absence of commercial harvest in historical times (Pritchard, 1987a).

Nesting season Nesting has been recorded in late February, and may be inferred (from hatchling emergence) to commence in November, if not earlier, but December would appear to be the peak month (Pritchard, 1987a).

Foraging sites Green Turtles (of juvenile and adult size) occur around Belep, the Loyalty Islands and the main island of New Caledonia; suitable foraging habitat appears to be very widespread.

Migration The migratory movements of C. mydas nesting in the d'Entrecasteaux area are unknown. Turtles are known to move long distances eastward and westward to forage in New Caledonian waters, females tagged on Great Barrier Reef rookeries in Queensland, (Australia), and on Scilly Atoll (French Polynesia) having been recovered in New Caledonia.

POPULATION: Eretmochelys imbricata

Little is known of the Hawksbill population in New Caledonia. The species occurs, in similar numbers to C. mydas, in waters around Belep, also in the Loyalty Islands and around the main island (Grand Terre). Some low-intensity nesting may occur in Belep and in the Loyalty group is recorded at least on Lifou; a few appear to nest in the d'Entrecasteaux Reef system, and possibly some on Grand Terre (Pritchard, 1987a). Nesting by the species is generally regarded as of little importance (Richer de Forges in litt., 1 September 1986; Anon. [Service de la Marine Marchande et des Pêches Maritimes] in litt., 19 January 1987).

EXPLOITATION

Commodity The meat of both C. mydas and E. imbricata are eaten in New Caledonia. Eggs are also eaten, though this is technically illegal. Some Hawksbill carapaces are occasionally sold to tourists.

Hunting intensity The inhabitants of Belep make sporadic visits to Ile Surprise to collect turtles but only three trips were made in 1985 and 1986. Other turtles are caught in the waters around Belep. Fishermen from Ouvea occasionally visit Beautemps-Beaupré but turtles are also caught around Ouvea. The locals apparently consider that permits are not necessary. In Grand Terre, permits must be obtained to catch turtles during the close season. The number of turtles taken under permit are shown in Table 149. The take during the rest of the year is unknown. There are reports that visiting fishermen, possibly Taiwanese, occasionally kill turtles on Ile Surprise (Pritchard, 1987a).

Table 149. Permits granted for the capture of sea turtles during the close season in New Caledonia.

	1978	1979	1980	1981	1982	1983	1984	1985	1986
Permits issued	9	10	6	5	5	9	5	3	3
Turtles caught	68	39	44	32	20	37	25	24	24

Hunting methods Some turtles are caught during rare visits to the nesting beaches while others are taken in the waters surrounding the inhabited islands.

Historical trends Apart from occasional visits by ships, there is no evidence of any exploitation of turtles other than the traditional subsistence use.

Domestic trade There is reported to be no trade in turtle meat, all being used for subsistence and traditional purposes. Carapaces are occasionally sold to tourists but this is illegal and is usually stopped (Pritchard, 1987a).

International trade New Caledonia is an Overseas Territory of France and is included in its approval of CITES (11 May 1978). CITES Annual Reports contain no reference to any trade in turtle products involving New Caledonia.

Fijian Customs statistics (q.v.) report the export of small quantities of worked tortoiseshell to New Caledonia in 1970 and 1973-1976, and the import of slightly greater quantities from New Caledonia from 1981 to 1983.

LEGISLATION

Ordinance No. 220, 3 August 1977.

The capture of all species of turtle is prohibited from 1 November to 31 March, inclusive. This may be waived under special dispensation for the purposes of traditional feasts and ceremonies.

Collection of turtle eggs is totally prohibited. The sale of mounted turtles and turtle shells is prohibited (came into effect 3 February 1978). [This regulation was superseded in 1985].

Déliberation No. 17 du 16 juillet 1985 portant réglementation de la capture et de la commercialisation des tortues marines.

Prohibits the destruction of sea turtle nests and the removal, possession and sale of turtle eggs.
Prohibits the import, export, sale and purchase for commercial purposes of live or dead turtles and all turtle products. The collection of turtle eggs and export of turtle products may be permitted for the purposes of scientific research and conservation.
The capture of all sea turtles is prohibited between 1 November and 31 March except under special permits issued for traditional ceremonies.

NEW ZEALAND

POPULATION

No nesting is known on the New Zealand mainland or the Kermadec Islands (B.D. Bell in litt., 15 January 1987). The Green Turtle is reportedly "very rare" around the mainland, and the Hawksbill "even rarer" (Pritchard, 1982a); the former occurs in moderate abundance (B.D. Bell in litt., 15 January 1987) around the Kermadec Islands, as a feeding population present primarily between January and March (Oliver, 1910, cited in Pritchard, 1982a).

EXPLOITATION

There is no regular exploitation of turtles and little trade in turtle products. The occasional animal taken in trawls is normally released if not already injured or killed (B.D. Bell in litt., 15 January 1987).

International trade New Zealand is not a Party to CITES but CITES Annual Reports indicate imports from New Zealand of mostly single shells, two to the USA in 1980, one in 1983 and one to the UK in 1985. Both Papua New Guinea and Seychelles have reported exporting two and four shells respectively to New Zealand; F.R. Germany reported exporting 3 kg of meat in 1984. Some turtle products are reportedly exported to New Zealand from the Cook Islands (Balazs, 1982c).

LEGISLATION

Wildlife Act 1953

Hunting and export of sea turtle prohibited.

NICARAGUA: CARIBBEAN

POPULATION: *Chelonia mydas*

Nesting sites It is unclear if *C. mydas* nests. Carr *et al.* (1982) noted that they received no reports of *C. mydas* nesting. In 1980 an aerial survey of 120 miles (c. 190 km) of the mainland coast from Punta Perlas to Dakura revealed only eight turtle nesting tracks, all old and partly obscured and not identifiable as to species. No *C. mydas* nesting is reported by Montiel (1984); Parsons (1962) stated that the species seldom nested on the Miskito Coast, although cited no evidence that it did so at all.

Nesting numbers See above.

Foraging sites Excellent Green Turtle foraging habitat occurs along most of the coast and offshore cays but most particularly on Miskito bank off the northern half of the country (Carr *et al.*, 1978); this is reportedly by far the largest foraging ground in the entire Atlantic system (Carr *et al.*, 1978) and, according to Carr *et al.* (1982), may be the most extensive anywhere. Turtles are taken here year round and Carr *et al.* (1978) argue that this area is a home feeding ground where turtles nesting at Tortuguero in Costa Rica (see below) spend considerable parts of their adult lives.

Migration Tag returns indicate that the waters off Nicaragua, particularly the Miskito bank area, are the principal feeding grounds of the Tortuguero nesting colony in Costa Rica; as of 1981, 725 tags from Tortuguero-marked *C. mydas* had been recovered from the Miskito Cays area of Miskito Bank, 142 from the Sandy Bay Cays and 263 from localities along the mainland coast (see COSTA RICA account). Two *C. mydas* tagged at Aves Island in the western Caribbean have also been recovered at Miskito Cays, implying the area may also serve as a feeding ground for at least part of this population (Meylan, 1981).

POPULATION: *Eretmochelys imbricata*

Nesting sites Nietschmann (undated, based on 1971 field work) noted that Hawksbill nesting beaches were scattered along isolated areas of the mainland and on some of the smaller offshore cays. He stated the major known nesting beaches to be found in the following areas: the mainland beach immediately north and south of Cocal on the southern coast of eastern Nicaragua (40 km north of San Juan del Norte); scattered sites along the Set Net Peninsula from Parakeet Point to c. 15 km south of Tasbapauni; the Set Net Cays, including Water, Grape, Wild Cane, Crawl, Baboon, Lime, Vincent, Black Mangrove and the two Tangwira Cays, of which the Tangwira Cays were the most important; the Asking Cay area, notably Big Asking Cay and the southern Savanna Cay; the Kings Cay area, notably Swirri Cay and Big Kings Cay. They were also suspected to occur on many of the other cays, especially some of those which made up the Miskito Cays. He considered at that time that the beach around Cocal was the most important Caribbean nesting site for Hawksbills in Nicaragua; later (cited in Carr *et al.*, 1982) he stated that the only unspoiled Nicaraguan nesting localities for Hawksbills were in the Pearl Cays complex (i.e. including the Set Net, Asking and Kings Cays regions listed above), with Maroon Cay the best of these.

Nesting numbers Montiel (1984) estimated a population of perhaps 25 nesting females in 1981.

Trends in nesting numbers Nietschmann (no date) implies that the species has declined although there is a scarcity of numerical data.

Foraging areas Nietschmann (no date) notes that the Hawksbill ranges from the Miskito Cays area in the north to the waters off San Juan del Norte; although they were found in many of the same feeding grounds (20-30 fathoms in depth) and sleeping shoals (3-5 fathoms) used by the Green Turtles, most were concentrated off the middle and southern coast of Nicaragua. He cited most of the known Hawksbill areas as: shoals in the immediate vicinity of Tyara Cay, 18 km east of Río Grande Bar; Tungla Shoal, 7 km east-south-east of Tyara Cay; Kamutrabuskan Shoal, 6 km south-south-west of Tyara Cay; Lupia Banks; Ao Dakura (Western Rock), 6 km south-west of Kings Cay; small shoals 4-8 km south of Kings Cay; Kalinbila Shoal, 11 km east-north-east of Kalinbila Cay in the Set Net Cays; waters around several cays off Honesound Bar and south to Monkey Point; Greytown Banks, 15 km east of San Jaun del Norte.

Migration Tagging returns suggest that some parts, at least, of the Caribbean Nicaraguan population may make long distance journeys. Four Hawksbills tagged at Tortuguero in Costa Rica have been caught in reef foraging areas off the Miskito Cays; one female tagged near Miskito Cays was recovered nesting at the Pedro Cays, Jamaica, some 390 miles (c. 625 km) away and a male also tagged at Miskito Cays was taken off Almitante Bay, Panama, near a nesting beach frequented by Hawksbills (Parsons, 1981).

THREATS

The principal threat is undoubtedly exploitation of turtles and their eggs and incidental take, principally by shrimp trawlers. Latest figures (in Montiel, 1984) indicate that incidental take of Chelonia mydas exceeds deliberate capture in the Caribbean. Cornelius (1981) notes that the incidental capture of turtles in shrimp nets on the Pacific coast is generally low, probably because most trawling takes place at depths of greater than 20 m, inshore waters being rocky and poorly known; this tends to reduce contact between trawlers and turtles near nesting beaches.

EXPLOITATION

Hunting intensity Latest available figures indicate a 1982 take on the Caribbean coast of 720 Chelonia mydas, reportedly used only for subsistence and local sale (Montiel, 1984). If this figure is accurate, it represents only c. 10% of the harvest level of the early 1970s. Incidental take for 1982 appears to be only 910 lbs (414 kg), with that for 1981 slightly higher (exact figure illegible); that for 1980, however, is given as 53 144 lbs (24 156 kg) (Montiel, 1984). It is not clear whether these figures represent live weight or yield, and thus the number of turtles involved cannot be estimated. Although according to Montiel (1984) there is no officially recorded harvest of Eretmochelys, Carr et al. (1982) and Nietschmann (1981) indicated intense and sustained harvest levels of both turtles and eggs and some tortoiseshell is officially reported as having been exported in each of the years 1980-82 (see below). In 1979 one female Hawksbill was reportedly worth up to $50 or $60 from the sale of its shell, meat, eggs, skin and calipee, this being equivalent to one or two weeks'

wages. Nietschmann (1981) estimated harvest to be around 1000-1200 turtles per year, noting that the species was subjected to year-round, almost continuous exploitation. In 1971 and 1972 surveys of the Pearl Cays region indicated that 90-95% of Hawksbill nests in the region were found and excavated by turtlemen (Nietschmann, no date).

Hunting methods Nietschmann (1981) notes that Hawksbills are caught in Caribbean waters by a variety of means: turtle nets set over coral shoals to entangle Hawksbills when they surface for air; harpoons with detachable points and long lines also used when turtles are on the surface; hooprings and nets dropped from the surface onto sleeping and feeding turtles below; "bay nets" strung up from stakes in front of nesting beaches. Hawksbills were also taken by skin and scuba divers, originally largely in pursuit of lobsters, but by the late 1970s often concentrating solely on turtles.

Green turtles in Caribbean waters are apparently taken mostly with nets and harpoons.

Historical trends Both commercial and subsistence turtle fishing are long-established along the Caribbean coast of Nicaragua. Nietschmann (1981) notes that the Miskito Indians of the coast of Nicaragua and adjacent Honduras are the foremost Amerindian turtling society in the Caribbean and are, or have been, effectively culturally dependent on Green Turtles. Prior to the late 1960s, when intensive commercial exploitation began, subsistence turtling (virtually all _C. mydas_) provided up to 70% of animal protein in the diet of coastal Miskito Indians. In one year in the late 1960s, the inhabitants of Tasbapauni village north of Bluefields took 819 Green Turtles (Nietschmann, 1970 cited in Parsons, 1972).

The history of commercial turtling in these waters is summarised by Parsons (1962). As early as 1633 Miskito Indians supplied turtles to English traders at Cape Gracias a Dios and by 1722 vessels from Jamaica were buying turtles from the Miskito to supply the Jamaican market. By the early 19th century turtlers from the Cayman Islands were visiting the Miskito Bank to supply the markets in Belize and Jamaica, mostly with Green Turtle but also with tortoiseshell. In summer 1905 there were reportedly 23 Cayman turtling vessels at the Miskito Cays, each one taking 100-200 turtles. In the mid-1950s there were 10-12 Cayman vessels fishing here, taking an estimated 2000-3000 Green Turtles each year, for which a nominal fee was paid to the Nicaraguan government. Some were slaughtered and the meat sun-dried _in situ_, while the majority were carried live at the end of the season to Grand Cayman. In the 1960s the Nicaraguan Government closed the turtle grounds to Cayman Islanders (Nietschmann, 1969).

The development of the commercial Green Turtle fishery at the end of the 1960s, and consequent decline of subsistence utilisation is described by Nietschmann (1979a, 1979b and 1981). In 1969, following the refusal of Nicaragua to accept a three-year moratorium on Green Turtle exploitation, the first of three turtle processing companies began purchasing and exporting turtle meat, calipee, skin and oil. From 1969 to 1976, 5000 to 10 000 Green Turtles were exported from Nicaragua annually, with evidence of depletion of the population; in 1971, on average two man-days were required to take one turtle, by 1975 six man-days were needed (Nietschmann, 1979a, cited in Nietschmann, 1981). The number of turtles taken, however, increased in this period as more Miskito were hunting and were doing so almost year-round (Nietschmann, 1979a, cited in Nietschmann, 1981). By 1976 the three plants were each processing an average of 200 turtles a week at the height of the turtle season. In 1976 a moratorium was placed on the

export of sea turtles and the three plants reportedly closed (Wells, 1979), although considerable quantities of C. mydas products have been exported since then (see below).

Commercial turtling for tortoiseshell also dates back at least to the end of the 17th century (Nietschmann, no date; Parsons, 1972). Nietschmann (1981) notes that the intensity of Hawksbill exploitation has been always been determined more by commercial than subsistence factors. In the late 1960s commercial demand for tortoiseshell increased, leading to increased hunting effort. Thus between 1969 and 1971 the local market price for shell in eastern Nicaragua increased by 50%, leading to exploitation increases of up to 400% in one Miskito village. By 1978 the price had risen 600% (Nietschmann, 1981).

Domestic trade At least up to 1982 Green turtles were legally taken for subsistence and local sale (see above).

International trade From 1972 to 1975 Nicaragua exported over 70 000 kg of turtle products (presumably all or most Chelonia mydas) per year to the USA; before 1972 exports to the USA were low. In 1976, following the closure of the three turtle packing plants, exports to the USA dropped to less than 1500 kg. Switzerland also imported 989 kg of calipee in 1976 (Wells, 1979). CITES-reported trade (excluding a small number of personal imports of eggs to the USA) since 1976 is detailed in Table 150. Nicaragua ratified CITES on 6 August 1977.

Table 150. CITES-reported exports of Chelonia mydas products (meat, soup, calipee) from Nicaragua, 1977-84. (kg). * = live (no. of animals).

Year	1977	1978	1979	1980	1981	1982	1983	1984
F.R. Germany	-	860	8243	21577	-	29	-	137
Cayman Islands	-	-	-	300*	-	-	-	-
Switzerland	574	-	-	-	-	-	-	-

Although no deliberate take of C. mydas is reported for 1980 in Montiel (1984), a yield of 53 144 lb (24 156 kg) in incidental take is reported for that year.

Although not reported by CITES, commercial trade in tortoiseshell has also continued, reported both in Montiel (1984) and in Japanese customs statistics.

Table 151. Exports of bekko from Nicaragua to Japan, 1972-86.
a.= Figures (in kg) reported in Japanese customs statistics
b.= Figures (originally in lb) reported in 1980-82 Nicaraguan statistics (from Montiel, 1984).

Year	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1985
a. kg	1316	994	2646	1632	1446	1573	1014	949	7	475	417	192
b. kg									11	473	414	

The figures for 1980-82 accord almost exactly with those given in Montiel (1984) for export of Eretmochelys products from Nicaragua, indicating that, in that period at least, all or virtually all official tortoiseshell exports were to Japan. None of this trade is recorded in CITES annual reports, although a very small trade (all either illegal or personal effects) from Nicaragua to the USA is reported.

NICARAGUA: PACIFIC

POPULATION: Chelonia mydas

Nesting sites Specific information is lacking, although C. mydas is known to nest (Cornelius, 1981).

Nesting numbers No information, other than that it is less abundant than Lepidochelys olivacea, the most abundant species nesting here.

Migration One Green Turtle tagged at the nesting beaches in Michoacán has been recovered off Nicaragua (see MEXICO: PACIFIC account).

POPULATION: Eretmochelys imbricata

Nesting sites The species is reported to nest though specific information is lacking (Cornelius, 1981).

THREATS

Incidental capture of turtles in shrimp nets on the Pacific coast is generally low, probably because most trawling takes place at depths of greater than 20 m, inshore waters being rocky and poorly known; this tends to reduce contact between trawlers and turtles near nesting beaches (Cornelius, 1981).

EXPLOITATION

Cornelius (1981) noted that nesting turtles were rarely killed, except by an occasional coastal family for fresh meat. Eggs were very heavily exploited, however. Although the great majority were Lepidochelys olivacea, the eggs of other species were doubtless taken when encountered.

LEGISLATION

Reglamento No. 14, 20 August 1958.
Authorises limited collection of Pacific Coast turtle eggs for non-commercial purposes.

Decreto No. 204, 12 July 1972.
Authorises the taking of Atlantic Coast turtles for local consumption.

Decreto No. 625, 18 March 1977
Prohibits commercial hunting and export, including transit for purposes of export, of wildlife and wildlife products. Establishes a ten-year

ban on the export of turtle eggs and provides authority to regulate their internal commerce and consumption.

Disposiciones con respecto al aprovecchamiento de huevos de tortugas marinas 1982.

Closes one of the two major laying beaches for sea turtles, the Chacocente beach, during the laying season. The collection of turtle eggs on that beach is prohibited except for subsistence needs of neighbouring communities. Only the collection of L. olivacea remains authorised.

Total protection of eggs:
- C. caretta
- E. imbricata
- D. coriacea

Partial protection: L. olivacea

Acuerto No. 2., 1983.

Prohibits the hunting of:
- C. caretta
- E. imbricata

No information available. Both C. mydas and E. imbricata seem likely to occur in Nigerian waters; a significant portion of the coastline is estuarine in nature, with mangroves, and appears unsuitable for turtle nesting.

International trade Nigeria ratified CITES on 9 May 1974. The only exports of turtle products from Nigeria recorded in CITES Annual Reports was in 1983 when the USA reported illegal imports of two Cheloniidae and one C. mydas, and the UK reported imports of two shells of C. mydas. In 1978, the Seychelles reported exporting one body of E. imbricata to Nigeria.

LEGISLATION

Endangered Species (Control of Internationa Trade and Traffic) Decree 1985, 20 April 1985.

Implements CITES, and prohibits the hunting of species threatened with extinction. [Sea turtles, being listed in Appendix I of CITES, might be expected to be included as "threatened", but they do not appear in the list of protected species.]

NIUE

Niue appears to have few, if any, suitable beaches for nesting turtles (B.D. Bell in litt., 15 January 1987). No further information available.

Niue is not a Party to CITES and CITES Annual Reports contain no record of any trade in sea turtle products with Niue.

POPULATION

Few turtles appear to nest in the Marianas. Although Saipan, for example, has several kilometres of beach on the west coast, very little nesting beach is available in the Marianas generally (Pritchard, 1982b). However, rather large numbers are taken in the area, for food or production of tourist goods (Pritchard, 1982b), so appreciable foraging populations presumably exist. Both C. mydas (apparently predominant) and E. imbricata have been recorded.

EXPLOITATION

Commodity Turtles are caught for sale to hotels and for the preparation of stuffed specimens and other tourist goods (Pritchard, 1982b).

Hunting intensity Pritchard (1982b) described the numbers of turtles captured as "rather large", saying that a diver could easily catch four to five turtles a day.

Hunting methods The aboriginal inhabitants of the Northern were mostly exterminated or evacuated to Guam during the early Spanish colonial period (Johannes, 1986). Hunting today is said to be carried out by divers (Pritchard, 1982b).

Historical trends The levels of harvest are said to be increasing (Pritchard, 1982b).

Domestic trade Stuffed turtles were said to be on sale in several locations on Saipan (Pritchard, 1982b).

International trade International trade with the Trust Territory as a whole is discussed under PALAU.

LEGISLATION

The USA Endangered Species Act still applies in the Commonwealth of the Northern Marianas as do CITES regulations (see under PALAU). The Commonwealth has a similar status to Puerto Rico.

POPULATION: <u>Chelonia mydas</u>

Nesting sites A large population nests at Ras al Hadd, the eastern-most point of Oman's coast, while minor nesting beaches exist near Salalah (near the border with PDR Yemen), at Ras Madraka, on Masirah and the nearby mainland, at Ras Jiksh, at Al Ashkara (Ross and Barwani, 1982), also in the Damaniyat Islands at Bandar Jissah, around Ras al Khayran, Khaysat ash Sheikh, Sitat ash Shaikh, As Sifah and Ras Abu Daud, all in the Capital Area of Oman (IUCN, 1986b). The species appears to nest on most beaches in the Dhofar area, with the partial exception of Salalah Bay where human interference means that nesting is minimal. However, nesting habitat is not continuous: in the west of Dhofar limestone cliffs drop straight to the sea, and in the east there is much rock on the beach, and nesting females may make many trial nest excavations (L. Barratt pers. comm., March 1986; unpublished observations).

Nesting numbers Ross and Barwani (1982) reported that a minimum of 6000 females nested annually on the 11 km of beach at Ras al Hadd, while up to a few hundred might nest at each of the eight minor nest sites named above. Data presented by Ross (1987) indicate that from 1983 to 1987 between 40 000 and 150 000 nests of <u>C. mydas</u> were laid at Ras al Hadd each year. However, Ross (<u>in litt.</u>, 27 July 1988) cautioned that these estimates were based on counts of tracks from only one night per week and that no allowance was made for false crawls. He therefore considered that they were excessive and chose to stand by his earlier estimate of 6000 females per year. Ross (1985) estimated the Masirah nesting population at 200 annually. There are around 1000 nests made in the Capital Area, approximately 80% of these in the Daymaniyat Islands, representing perhaps 300 females annually. Up to 30 females of <u>C. mydas</u> and <u>C. caretta</u> combined may nest nightly on certain beaches in Dhofar, but the proportion of <u>C. mydas</u> is unknown, and nesting is scattered, beaches adjacent to those with much nesting perhaps having virtually no nesting (L. Barratt, <u>pers. comm.</u>, March 1986; unpublished observations).

Trends in nesting numbers There is no evidence that numbers were greater in past times although the Ras al Hadd population seems now to be subject to some disturbance arising from development and recreational use of the beach.

Nesting season Although nesting takes place throughout the year at Ras al Hadd, this is at a low level from January through to July; most nesting occurs between August and December, with about half of the annual total in August-September. The peak is about a month later on Masirah, with over half the annual total occurring in September-October, and the season extending into January (there is no recorded nesting in February-May) (Ross and Barwani, 1982). Green Turtles in the Greater Capital Area nest during the summer month, with a peak between July and October (IUCN, 1986b).

Foraging sites Known feeding grounds are located to the west of Salalah, in Sawqira Bay, the Gulf of Masirah and along the Batinah coast (Ross and Barwani, 1982). Although the feeding area is extensive, stretching from around 800 km, quality and productivity are low. The predominant seagrasses are species of <u>Halophila</u> and <u>Holodula</u> which, according to Ross and Barwani, are hardy pioneer forms present in low biomass. Ross (1985) estimated, on the basis of aerial surveys and mark-recapture study, that 1000-3000 turtles occur on feeding grounds in the Masirah Channel, more than 99% of them <u>C. mydas</u>. The nesting area of these turtles is unknown. Dense foraging populations occur off the Dhofar coast, often around 40 turtles being seen in one view (L. Barratt pers. comm., March 1986; unpublished observations);

although the species composition is not known, most seem likely to be C. mydas.

Migration A female tagged at Ras al Hadd was recovered three months later, 22 220 km away in Ethiopia, near the mouth of the Red Sea at Assab, Ethiopia (Ross and Barwani, 1982); others have been recovered from Ras al Khaimah in the Gulf, Somalia (Ross, 1985), PDR Yemen and UAE. (Ross, 1987). Ross (in litt., 29 December 1986) notes that tags from two turtles tagged in Oman have been recovered in the Gulf area, but raises the possibility that these tags may have been derived from turtles taken on the Ras al Hadd nest beach and transported overland by fishermen. The more complete pattern of migratory behaviour of this population is unknown; females nesting at Ras al Hadd may move eastward toward Pakistan and India or, like some PDRY turtles, south-west to the Somali coast. Similarly, turtles feeding in Oman may nest elsewhere.

POPULATION: Eretmochelys imbricata

Nesting sites A small population nests around the southern tip of Manoah Island (Ross, 1981). More recently, the Daymaniyat Islands have been shown to be an important nesting centre with nesting also at Bandor Jissah and other beaches, particularly Ras al Khayran, Sitat ash Shaikh and Ras Abu Daud, in the Greater Capital Area (IUCN, 1986b; Salm, 1986).

Nesting numbers Around 1000 nests were estimated to be laid in the Daymaniyat Islands during spring 1986 (based on regular weekly counts) (Salm, 1986), with around 470 mainland sites in the Greater Capital Area. An estimated 250 Hawksbills nested in the Daymaniyats in 1986: this is a large number nesting in a relatively small area and places these islands among the world's most important Hawksbill nest sites (Salm, 1986). More than 50 turtles nest at Bandar Jissah (IUCN, 1985b). The Masirah population is estimated at 90-125 females annually (Ross and Barwani, 1982).

Nesting season Hawksbills in the Greater Capital Area nest in winter, with a peak between January and April (IUCN, 1986b). Nesting on Masirah runs from January to May, with well over 50% of the annual total in March.

Foraging sites Some Hawksbills are seen throughout the year around Masirah (Ross and Barwani, 1982), and in the Greater Capital Area, including seas off Bandar Jissah (IUCN, 1986b). Turtles seen here outside the breeding season may be presumed to be foraging in the area, but little specific information in available.

THREATS

Ross (in litt., 29 December 1986) notes that development of the airstrip at Masirah provides a backlighting problem which can disorient turtles; village development and use of home generators at Ras al Hadd disrupts nesting on about one-third of the beach (although large numbers still nest successfully). Disturbance is also likely to affect nesting in the Capital Area, and is affecting Hawksbills in the Daymaniyat Islands.

EXPLOITATION

Commodity The meat and eggs of C. mydas are consumed by the coastal people in the vicinity of Masirah Island. Further north, turtles are regarded as inedible, and are usually discarded when they are found in fishing nets (Ross, 1985). The people of Masirah Island regard the meat of E. imbricata and L. olivacea to be poisonous, and neither species is molested, although the eggs are collected (Ross, 1980-81). Hirth and Hollingworth (1973) reported that C. caretta was not eaten on Masirah Island. Coastal people in the Capital Area of Oman do not generally catch turtles for food, although readily collect turtle eggs, mostly of E. imbricata (Salm, 1986).

Hunting intensity The number of turtles landed on Masirah Island has been monitored since 1977, although recently the sampling period has dropped to as little as two months a year. The estimated annual harvests ranged from 116 to 327 (Table 152), with a mean of 203 (Ross, 1987). Ross (1985) pointed out that there were undoubtedly other turtles butchered on Masirah which had not been recorded and that the mainland community of Mahoot also caught similar quantities of turtles. He estimated that the total harvest of C. mydas in the Masirah channel was in the region of 500 a year (out of a total estimated foraging population of 1000-3000), and that a further 500 may be caught along the rest of the Omani coast.

Table 152. Estimated annual artisanal harvest of C. mydas at Masirah based on sampling periods ranging from 2 to 12 months a year (Ross, 1987).

Year	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Est. harvest	243	175	273	327	174	116	161	202	255	142
Months sample	12	7	12	10	7	3	2	2	3	5

In the northern Oman, turtles are said not to be hunted generally, although some may die as a result of being caught accidentally in fishing nets (Salm, 1985). However, Ross and Barwani (1982) reported that about 100 C. mydas were caught annually on the nesting beach at Ras al Hadd and transported in trucks to be sold in Abu Dhabi (UAE). They cautioned that this trade was small at that time, but implied that it might increase. Salm (1986) estimated that about 3% of the nests of E. imbricata on the Daymaniyat Islands were robbed by fishermen. Human predation of turtle nests on the mainland in the north of the country was much less important in relation to the 60-80% mortality caused by foxes and other natural predators.

Hunting methods Turtles are mostly caught with hand-held harpoons in shallow water from small canoes. Outboard motors are increasingly being used to power the canoes. Fishermen at Masirah test the quality of the turtle by making an incision in the shoulder; turtles not having the required combination of bright, thick blood, abundant fat and red meat are released. Of a total of 6-8 turtles harpooned in a day, only one or two are retained. Occasionally turtles are caught in nets set for fish. Most of the turtles are caught from March to May, when the fishing is poor and the weather is good (Ross, 1985). Turtle eggs are collected from the nests at several localities along the coast, and Salm (1986) observed a fisherman on the Daymaniyat Islands cutting open a nesting female to extract her developing eggs

Historical trends There is no direct evidence of the historical levels of exploitation of turtles in Oman. However, the fact that the fishermen are highly selective about which animals are retained, releasing some 75% of those caught, suggests that there is still a surplus of turtles in the area in relation to the demand. It was reported (Ross and Barwani, 1982) that the killing of nesting turtles had been banned on Masirah Island because it was thought to have caused the nesting population to decline. Ross (1985) expressed fears that the introduction of outboard motors had increased the mobility of the fishermen, and might result in an increased catch. Similarly, the wider availability of motor transport on Masirah may have raised the level of egg collection on remote beaches (Ross, 1980-81).

Domestic trade Ross (1985) reported that there was no trade in turtle products on Masirah Island, all the meat being consumed by the families and friends of the fishermen. A few juvenile turtle carapaces may be prepared and sold to overseas tourists (Ross, 1980-81).

International trade DeGaury (1957) reported that there used to be a trade in tortoiseshell from Masirah Island to the coast of Africa, but Ross (1980-81) could find no memory of this trade amongst the island's inhabitants, and concluded that it had ceased with the demise of the Dhow trade.

Ross and Barwani (1982) indicated a small, overland trade in Green Turtles from Ras al Hadd to UAE. They said that about 100 turtles a year were taken in small trucks for sale in the fish market in Dubai. Ross (in litt., 29 December 1986) suggests that this trade is continuing, although it involves mainly fish.

Oman is not a Party to CITES, but CITES Annual Reports between 1977 and 1985 record the import into the UK of three *C. mydas* shells from Oman and the export of 227 kg of *C. mydas* bones to Oman from the UK in 1982.

LEGISLATION

Ministerial Decree No. 3/82. Executive regulations for law of marine fishing and conservation of aquatic resources.

> All capture of turtles is prohibited during the nesting season, as determined by the appropriate authority [15 July to 15 October in 1982]. Collection of eggs is prohibited within a distance of the coast which is to be determined by the appropriate authority. Hunting of turtles on their way to lay eggs on the islands and coasts is prohibited during periods which are determined by the appropriate authority.

These regulations are interpreted to prohibit the commercial hunting of turtles and to permit only subsistence hunting outside the nesting season. Efforts are made to persuade people to collect only the eggs which are laid below the high tide mark.

POPULATION: Chelonia mydas

Nesting sites The best known nest sites are in Sind Province, where nesting is known or suspected to occur on most beaches and sand coves between Manora Lighthouse, at the entrance to Karachi harbour, and Cape Monze, some 40 km to the west. Virtually all known nesting in this area takes place just west of Karachi city, along a 20 km stretch of beach divided by a rocky headland into two sectors, Sandspit and Hawkes Bay, with most nesting on the Hawkes Bay sector (Kabraji and Firdous, 1984). The Sind coast around Cape Monze is predominantly rocky and unsuitable for turtle nesting. Nesting, mainly or entirely by C. mydas, also occurs at points along the extensive Makran coast of Baluchistan (Kabraji and Firdous, 1984); Ormara (Telford, 1976), Ras Jiunri (= Jiwani) (Shockley, 1949) and Astola Island (Butler, 1877) have been cited in the past. Recent information (Groombridge et al., 1988) confirms that C. mydas still nests at Ormara and Jiwani, also at Gwadar and Pasni, and on Astola (= Haft Talar) (A.L. Rao, pers. comm.). A recent aerial survey (Groombridge, Rao and Kabraji, unpublished) found no evidence of significant nesting other than in the vicinity of these sites. There are five nesting beaches around the Jiwani headland, about 8-10 km in total length, and a similar length around the west side of Ormara West Bay. The beach on Astola approaches 2 km (Rao, pers. comm.). Gwadar and Pasni are very minor sites.

Nesting numbers An annual total of around 1500 C. mydas nests are laid on the 5 km stretch of beach at Hawkes Bay where nesting is most dense (Kabraji and Firdous, 1984). The annual mean for the years 1980-1985 is 1286 (Table 153). Since the entire Hawkes Bay-Sandspit area provides some 20 km of suitable nesting beach, there could be as many as 6000 nests each year (Kabraji and Firdous, 1984). However, nesting density is markedly higher along the 5 km reference beach than elsewhere, and it may also be assumed that each female will nest on more than one occasion, possibly several times. On this basis, the total number of females per year may be closer to 2000-3000 than 6000. On the other hand, an unknown proportion of nests are likely to have been missed, and the figure does not include the apparently sparse nesting that occurs elsewhere along the Sind coast.

Recent information from Baluchistan suggests that small numbers nest at Gwadar and Pasni, at least one or two hundred nest annually on the "lighthouse beach" at Jiwani, and probably one or two thousand at Ormara (Groombridge et al., 1988). Four additional beaches have recently been located on the Jiwani headland (Groombridge, Rao and Kabraji, unpublished), and total numbers in this region are likely to be similar to those at Ormara and Karachi. Large or moderate numbers appear to have nested on Astola in the last century (Butler, 1877). Nesting is still dense on Astola, comparable with maximum intensity on Hawkes Bay-Sandspit (Rao, pers. comm.). Suspected numbers at the Baluchistan sites combined with known nesting numbers near Karachi make Pakistan one of the most important C. mydas nesting areas in the Indian Ocean and one of the world's more important turtle coasts.

Trends in nesting numbers No detailed information is available. However, exploitation appears to have been intense at times, although perhaps irregular, and it seems likely that it would have had an impact on nesting numbers. Incomplete evidence suggests that one population, nesting in the Sonmiani area of Baluchistan, may have been extirpated. Local residents and earlier literature report that turtles formerly nested there, and a representative of the main company involved in reptile exploitation in Pakistan confirmed that turtles had been taken from Sonmiani. An aerial

Table 153. Nesting emergences by C. mydas on the 5 km study beach within the Hawkes Bay-Sandspit area, Karachi (data from the Sind Wildlife Management Board turtle project; K. Mohammed Khan in litt., 23 December 1986). Note that these figures refer to nesting emergences, not individual female turtles.

1979 (Oct.-Nov. only)	1980	1981	1982	1983	1984	1985	1986 (up to Nov. only)	mean 1980-85
44	799	1168	1406	1456	1339	1549	126	1286

survey in September 1988 found no trace of recent or old nesting pits or tracks in the Sonmiani area (Groombridge, Rao and Kabraji, unpublished).

Nesting season Some nesting occurs on Hawkes Bay and Sandspit throughout the year, with a peak period during September-November, the latter being the peak month (Kabraji and Firdous, 1984). Nesting was recorded at Ras Jiwani during the same period (Shockley, 1949), but observations were limited to the period between early September and early November (in 1945) and there are few data on nesting levels at other times of year at this site. Moderate nesting by C. mydas was occurring in January 1987 (Groombridge et al., 1988); heavy nesting is reported by local residents during March and was observed during September 1988.

Foraging sites Green Turtles, including sub-adults, are encountered off the Sind beaches through much of the year, with the exception of the monsoon period (April-August), when rough seas have not permitted investigation; turtles may in fact be present all year (Kabraji and Firdous, 1984). This coast may provide foraging for a largely resident population, and for a population which nests elsewhere; this is unknown at present. There is no information on foraging numbers. Turtles have reportedly been seen grazing algae off rocks, and a variety of algae together with fragments of molluscs and crabs have been found in gut contents (Kabraji and Firdous, 1984).

POPULATION: Eretmochelys imbricata

There are no records of Hawksbill breeding in Pakistan (Minton, 1966), certainly not in Sind, although the species may nest in Baluchistan, where no detailed investigations have yet been made. There appear to be no recent records of the species in Pakistani waters, although it may be presumed to occur as a vagrant at least. According to Khan and Mirza (1976) the species occurs rarely along the Pakistan coast.

THREATS

The Sind population of C. mydas appears to be at some risk due to disturbance, the Hawkes Bay-Sandspit beaches being much frequented by Karachi residents and also backed by a continuous line of beach houses, some partially derelict. Adult turtles are occasionally lured inland by the glow of lights from Karachi city and hatchlings are regularly found on the road inland from the beach houses. In recent years, the Karachi Development

Authority has taken large volumes of sand from the beach for construction purposes, but this has now ceased (Firdous pers. comm., January 1987). Some beach houses are lit late into the night, which is likely to deter nesting females. Most seriously, the Karachi Development Authority is developing tourist facilities west of the main nesting area at Hawkes Bay-Sandspit, and is upgrading the access road running behind the nest beach and beach houses (Firdous, Kabraji pers. comm., 1988). This is currently planned to include full-scale road lights; if not prevented, this is certain to have severe adverse effects on the Karachi nesting population.

The Baluchistan nesting populations have been heavily exploited in recent decades; this is certain to adversely affect recruitment in future season (see below).

EXPLOITATION

Commodities Marine turtles have not traditionally been hunted extensively in Pakistan. In Sind, neither the adults nor the eggs have been widely accepted as food, and at the very most, eggs have occasionally been used in traditional medicines (Hikmat) as a cure for asthma. The fishermen, who are Muslims, consider the turtle products to be "Makru", a term implying that it is religiously desirable not to consume them (Kabraji and Firdous, 1984). Shockley (1949) reported that at Ras Jiwani in the west of Baluchistan, the local Baluchis did not use turtles or their eggs as food. Any poaching that does take place is thought to be mostly the work of foreigners (usually South East Asians), and in the past there has been some exploitation for the export market (Kabraji and Firdous, 1984). Recent information from Baluchistan (Groombridge et al., 1988) indicates that small numbers of eggs are taken from nest beaches in Baluchistan (mainly for feeding to ailing stock), and that turtles are slaughtered in significant numbers, although apparently irregularly, primarily for export of oil and skin.

Hunting methods Little information is available: most turtles taken in Baluchistan (probably all of them) appear to have been females turned on the nest beach; this seems to have been the case around Karachi also.

Hunting intensity There is believed to be very little deliberate hunting of turtles in Sind (Kabraji and Firdous, 1984) although as noted above, there is significant exploitation in Baluchistan. At Ormara and on Astola Island local informants reported that collectors would camp on the beaches during the peak nesting period and slaughter every possible female as she came up to nest. This apparently occurred during several season in the 1970s and 1980s.

Historical trends Poaching of turtles and their eggs in Sind is believed to be less important now than it was previously (Kabraji and Firdous, 1984); it was heavy in the early 1970s and probably earlier. Little information is available for Baluchistan, although Butler's statement that Arab fishermen from Muscat used to take turtles for oil on Astola implies that Baluchistan turtles have long been subject to some exploitation pressure. No confirmation was found of exploitation after 1985.

Domestic trade There is reported to be very little domestic market for turtle products in Sind, although there may be some trade within the immigrant community. During the early 1970s (and possibly earlier), eggs were sold as a cheap alternative to poultry eggs in Karachi, mainly to large

bakeries who used them in bread and cakes (Kabraji and Firdous, 1984). Turtle eggs, apparently only in small numbers, are utilised in Baluchistan (Groombridge, et al., 1988).

International trade Export of turtle products is now illegal, but during the early 1970s there was some export of meat, mostly to Japan (Kabraji and Firdous, 1984). According to Ghalib and Zaidi (1976) local exporters had been trading in turtles and turtle products on an "extravagant" scale. Two Karachi firms, M/s. Kaiser Corporation and M/s. Ghazi and Co., were reportedly the major exporters, and had been involved in trading turtle skin and meat for a "very long" time. This exploitation was stopped by the Sind Wildlife Management Board in 1972.

Telford (1976) reported information from a reliable source that "many thousands" of turtles were taken during the 1975 season at Ormara (Baluchistan) by a Karachi trader who exported the leather through Japanese buyers. Local informants at Ormara reported that every turtle emerging was taken in 1985, although exploitation at Ormara has now ceased and will not be permitted in future (Groombridge et al., 1988.

Turtles taken at Ormara were butchered on the spot and the carcasses rendered for oil which was exported in drums to Muscat, reportedly to be used to treat wooden sailing dhows. Oil is also reportedly the main product of turtles harvested at Jiwani and on Astola. Because of the direct maritime links between the Baluchistan ports and Oman, no record is available of this export.

In spite of the complete ban on exports of turtle products since 1975, Pakistan's Customs statistics reported exports of raw tortoiseshell from 1981 to 1983. A total of 1800 kg were exported from July 1981 to June 1982, and 1868 kg from July 1982 to June 1983. It is not known what species this refers to.

There are also indications of exports from Pakistan in the Japanese import statistics (Table 154). No imports of "bekko" (E. imbricata shell) were reported from 1970 to 1985, and the only shell imported was in the category "Tortoiseshell claws and waste of tortoiseshell, excluding bekko". This, therefore, probably represents the shell of C. mydas. There were also reports of imports of turtle skin from Pakistan, and these are also given in Table 154. It is not known what species this refers to, but it was probably also of C. mydas.

Table 154. Imports of turtle products to Japan from Pakistan reported in Japanese Customs statistics by weight (kg) and value (Y1000).

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Shell (kg)	745	0	0	136	330	0	0	133	0	
" (Y1000)	856	0	0	214	466	0	0	201	0	
Skins (kg)	4648	1016	5360	3248	2100	2400	1200	0	0	2925
" (Y1000)	4755	1138	3626	3239	1920	2198	1995	0	0	3044

PAKISTAN

LEGISLATION

Azad Jammu and Kashmir Wildlife Act 1975 (30 December 1975).
The following species are fully protected:

C. caretta
Chelonia
E. imbricata
D. coriacea

A certificate of lawful possession, transfer or export of any trophy or meat derived from a protected animal, or of any live protected animal.

Baluchistan Wildlife Protection Act, 1974, 22 July 1974
As above.

Sind Wildlife Protection Ordinance 1972, 13 April 1972.
The following species are fully protected:

C. caretta
C. mydas
E. imbricata
D. coriacea

CITES Annual Reports only contain a single record in sea turtle products involving Pakistan, when the UK reported importing one shell of C. mydas in 1983.

POPULATION: Chelonia mydas

Nesting sites Some nesting has been reported (probably this species) on Ngeruangel at the northern extremity of the Palau group, and on Beliliou and Morei. Although sparse nesting is recorded in the north and south of the Palau Archipelago, by far the most important sites are Merir and Helen's Reef, isolated in the far south (Pritchard, 1982b; Johannes, 1986). Some nesting also occurs on Tobi, Sonsorol and Pulo Anna, which with Merir and Helen constitute the South West Islands region of Palau (Johannes, 1986).

Nesting numbers Nesting appears to be sporadic and to involve small numbers in northern Palau, but substantial numbers nested (in the late 1970s) on Merir and Helen (Pritchard, 1977 and 1982b). According to Pritchard (1977) these two islands probably support the largest C. mydas population in Micronesia; Pritchard estimated that up to several dozen may nest nightly. No recent or detailed information is available, however.

Trends in nesting numbers No details are available; Pritchard (1977 and 1982b) suggested that turtle populations in general in Micronesia have probably been declining slowly for centuries, and that current exploitation is likely to be adversely affecting turtle populations. Older Palauan fishermen were unanimous in their opinion that turtles were far less abundant in the mid-1970s than they had been 20-30 years previously, with a particularly noticeable decrease in the number of large C. mydas (Johannes, 1986). Although turtles seem never to have been abundant around Tobi, local residents reported to Johannes (1986) that numbers had decreased further in recent years.

Nesting season Nesting on Merir and Helen appears to take place throughout the year (Pritchard, 1977).

Foraging sites Suitable foraging grounds appear to be widespread. In the late 1960s (source cited in Pritchard, 1982b) mature C. mydas were common in Ngaruangl Lagoon, and, resident throughout the year, fed on seagrass pastures, particularly along the western edge of the reef. This species is infrequently encountered in the main Palau Lagoon system (Pritchard, 1982b).

POPULATION: Eretmochelys imbricata

Nesting sites Palau is the only part of Micronesia where this species appears to be more common than C. mydas (Pritchard, 1982b). Nesting occurs on small beaches in the Seventy Islands area of Palau Lagoon (Johannes, 1986), the two most-favoured being Eomogan and Ngerugelbtang, with occasional nesting on Ulong (Aulong), Nelangas, Ngebedangel, Unkaseri, and Bablomekang (Abappaomogan) (Pritchard, 1982b). According to Broughton (1986), nesting occurs on the rock islands south of Koror (precise locations were not given). No information is available on nesting by this species at the southern islands of Merir and Helen's Reef.

Nesting numbers Almost no details are available; one observer (cited in Pritchard, 1982b) saw three E. imbricata nest on Eomogan on one night, said to be one of the most important Hawksbill nest sites in Palau. This fragmentary evidence suggests that the Palau nesting population is not large. Milliken and Tokunaga (1987b) reported that egg collecting visits

made by ranch personnel (see below) to the Ngerukeuid Islands Preserve had located 55, 81, 71, 57 and 39 nests in the five years 1982-86.

Trends in nesting numbers Reliable reports (R. Owen, Conservation Officer for Micronesia 1949-1978, cited in Pritchard, 1982b) indicate a "gradual but steady" decline in E. imbricata numbers in Palau. In the mid-1970s, Palauan fishermen considered that turtles had declined in the previous 20-30 years. On Tobi, the locals became so concerned about the apparent decline of nesting turtles that they decided to prohibit the collection of eggs and erected fences around any nests found (Johannes, 1986). Broughton (1986) regards the Palau population as "steady".

Nesting season Most nesting takes place in July-August, with some in June and September, and possibly sporadic nesting throughout the year (Pritchard, 1982b).

Foraging sites The extensive Palau Lagoon system appears to be a major foraging area for E. imbricata, and the Ngcheangel (Kayangel) lagoon, at the north of the Palau group, reportedly holds numerous immature Hawksbills (Pritchard, 1982b).

THREATS

The breakdown of traditional beliefs and management practices, coupled with increased human populations and more efficient transport, fishing methods and equipment, have jointly put increasing pressure on turtle populations (Pritchard, 1977, McCoy, 1982; Johannes, 1986). Tourism has increased dramatically in Palau; a large proportion of tourists are from Japan, which has no restrictions on import of E. imbricata shell or products. The shell trade constitutes the main threat to this species in Palau (Pritchard, 1982b).

EXPLOITATION

Commodity The meat of C. mydas is popular in Palau. Up until some time after 1929 the meat of E. imbricata was taboo to all except old women, and was said to smell unpleasant. Hawksbills are now caught for their shell, and the meat is not wasted as it has been discovered that the unpleasant smell can be eliminated by repeated boiling in changes of water. The eggs of both species are eaten. The shell of Hawksbills formed the basis of an important traditional carving industry for fish-hooks, combs, spoons, cups and ornaments, said to be the most advanced in the ocaenic islands of the Pacific. By 1971, most of the traditional skills had died out and only two artisans were said to be producing carvings, and those were mostly for sale to tourists (Johannes, 1986).

Hunting intensity Johannes (1986) found that it was not possible to estimate the current harvest rates, but concluded that nowhere did turtle meat or eggs form an important item of diet. Pritchard (1982b) cited an estimate that the harvest of eggs was about 80%, and Madaraisao (cited in Anon., 1986e) reported that the egg harvest on the Seventy Islands was still 78%, in spite of the fact that they had become a sanctuary. Milliken and Tokunaga (1987b) reported that about 80% of eggs laid in the Ngerukeuid Islands Preserve were taken by poachers.

Hunting methods Palauans have the reputation for being the best fishermen in Micronesia. Johannes (1986) described several of the methods used for catching turtles: nets were apparently in use up to the late 1950s, but no longer in the 1970s, although some turtles may be caught accidentally in nets set for fish. Spearing is a common practice, sometimes carried out by large groups of canoes searching the reef, but spearguns are also used by skin-divers. Often a float is attached to the end of the harpoon line to allow the turtle to dive until it becomes exhausted, after which it can be recovered. An interesting technique, said to have been introduced by the Japanese, involves setting a floating trip-line in crevices where turtles are known to rest so that their arrival can be detected from the surface. Resting turtles can either be speared or have ropes tied to their flippers. Turtles are also killed on the nesting beaches, and the regular 14-day inter-nesting interval is understood and exploited. The fisherman can tell the age of eggs to within a day or two from the degree of calcification of the shell and the state of the embryo, and so know when to return to catch the female. They are also said to be able to tell whether it is the female's first or last nest of the season.

Historical trends While Green Turtles and turtle eggs have probably always been harvested commensurate with the needs of the local population, the harvest of Hawksbills has almost certainly increased as a result of commercial demand for shell, spurred on at least partly by the growing tourist trade (Johannes, 1986).

International trade Pritchard (1982b) pointed out a loophole in the legislation, under which tourists returning to the USA could legally bring turtle products with them because the Trust Territory has the same status as an American state according to the wording of the Endangered Species Act.

The Trust Territory of the Pacific Islands has been covered by the USA ratification of CITES since 14 January 1974. CITES Annual Reports only record trade with the Territory as a whole and not with island groups. Most of the records of trade have been of illegal imports to the USA of mostly single shells, totalling five E. imbricata, 12 C. mydas and two Cheloniidae between 1982 and 1984. Further evidence of tourist trade in turtle products was the reported commercial import to the Territory of 117 C. mydas carvings in 1980 from the Cayman Islands. There were no records in CITES Annual Reports prior to 1980.

LEGISLATION

Trust Territory Code is believed to be still in force. Title 45, Section 2 contained the following provisions:

The taking of E. imbricata of lengths less than 68.6 cm and of C. mydas of less than 86.4 cm is prohibited.

Taking of any turtles during the periods 1 June-31 August and 1 December-31 January is prohibited.

Turtles may not be killed on shore, and their eggs may not be collected.

The USA Endangered Species Act (q.v.) apparently applies to the Trust Territory, but there is a special exemption to allow a subsistence take of C. mydas.

E. imbricata is totally protected, being listed as Endangered.

C. mydas is listed as Threatened and may be taken by residents only, and "if such taking is customary, traditional and necessary for the

sustenance of such resident and his immediate family".
The sale of all turtle products is prohibited.

RANCHING

An experimental hatchery has been operating at the Micronesian Mariculture Demonstration Centre, Oreor (Koror) since 1982, with financial backing from the Japanese Tortoiseshell Association. Eggs of E. imbricata are collected and incubated in sand in styrofoam boxes at the Centre. After hatching, the turtles are reared in a 75-foot (23-m) concrete run to an age of about 6-8 months before being tagged and released. A total of 7255 eggs were collected between 1982 and 1986, and 51% hatched successfully. Survival to six months has been about 60%; 1423 juveniles have been released (Broughton, 1986).

PANAMA: CARIBBEAN

POPULATION: Chelonia mydas

Nesting sites Green Turtle nesting sites are apparently scattered along the coast. Carr et al. (1982) note that the species occasionally nests at Changuinola, Isla Bastimentos and Chiriquí Beach in Bocas del Toro Province, with the best of these being Changuinola, and also on the mainland opposite the San Blas Islands in eastern Panama. Ruiz de Guevara (1986) reported that young C. mydas appeared off San Blas at approximately the same time as young E. imbricata, indicating that some nesting may occur.

Nesting numbers No figures are available, though the species is evidently not an abundant nester (Carr et al., 1982). No Chelonia mydas nests are recorded in the 1983 WATS country report (Diaz, 1984).

Nesting season Quoted by Carr et al. (1982) as "during the summer months".

Foraging areas Carr et al. (1981) note that there appear to be extensive foraging grounds around Bocas del Toro, although they remained largely unsurveyed. Reefs and seagrass beds were known to exist around Isla Bastimentos, Isla de Colón, and the Zapatilla Cays as well as on banks further off shore. The area was considered to be an important temporary feeding station for migrating Green Turtles (from the Tortuguero breeding grounds - see COSTA RICA account), most of which were caught as they came in to feed on seagrass on the leeward side of the outer cays of the lagoon at Bocas; a small number of adult Green Turtles were resident, and were believed to feed on mangroves in the lagoons. Immature Green Turtles also occurred, but in smaller numbers. Green Turtles also occurred in some numbers in feeding grounds around the San Blas Islands; most of these were juveniles. Hatchling Green Turtles, presumed to come from Tortuguero, had also been found off the coast of Panama in offshore sargassum drift-lines (Carr et al., 1982).

Migration As noted above, the Bocas del Toro area is believed to serve as an important foraging area for migrating Green Turtles. Up to 1982, 32 turtles tagged at Tortuguero in Costa Rica had been recovered there (see COSTA RICA account).

POPULATION: Eretmochelys imbricata

Nesting sites In Bocas del Toro Province, the Hawksbill is known to nest on Chiriquí Beach (which extends for ca 29 km between Río Cañaveral and Río Chiriquí), on the three beaches on Isla Bastimentos, on several small beaches on Isla de Colón, on both of the Zapatilla Cays and at Changuinola (Carr et al., 1982). Further east, Hawksbills are believed to nest on many isolated nesting beaches on the San Blas Islands (Carr et al., 1982).

Nesting numbers Chiriquí is believed to be the most important nesting beach. A ground survey in 1980 (21-23 May) counted 17 Hawksbill nesting tracks and a second in 1981 (13-14 June) counted 13 (Carr et al., 1982). Because of the protracted nesting season and the short life-time of tracks on the beach it is not possible to derive population estimates from these brief surveys. Nesting activity is characterised as "low" by Bullis (1984), summarising unquantifiable information presented at WATS in 1983.

E. imbricata is said to be the most common turtle species in San Blas (Ruiz de Guevara, 1986).

Trends in nesting numbers It is believed that Hawksbills nested at Chiriquí in considerably greater numbers in the past, although there are no estimates. Carr (1956) on the basis of reports considered it probably to be the greatest concentration of Hawksbills nesting in the Caribbean. Ruiz de Guevara (1986) reported that E. imbricata appeared to nest on fewer and more remote beaches in San Blas than it had done in the 1960s and 1970s. He blamed the increase in hunting pressure for this decline.

Nesting season April to August, with a peak in May and June (Carr et al., 1982).

Foraging areas There are extensive foraging areas in the Bocas del Toro region, with Hawksbills found with relatively high frequency around Isla Bastimentos, Isla de Colón and on banks further off shore. Hawksbills were also relatively common in the abundant reef habitats around the San Blas Islands (Carr et al., 1982).

Migration A male tagged near Little Sandy Cay, Nicaragua on 20/10/1972 was recovered in Almirante Bay, Panama, near Chiriquí Beach on 10/5/74 (Nietschmann, 1981) and an individual tagged at Tortuguero in Costa Rica was recovered near Colón in Panama four months after being tagged (Bjorndal et al., 1985). These give indications of long-distance movements in Hawksbills but provide no conclusive evidence for regular migrations.

THREATS

Exploitation and incidental take are the factors most usually cited. Meylan (1984) also notes that a grave threat to the nesting and feeding habitats of Eretmochelys in Bocas del Toro Province is posed by the terminal for a trans-isthmus oil pipeline, completed in September 1982, which lies in the waters of Chiriquí lagoon. The lagoon is part of a complex of bays, islands, coral reefs and seagrass beds covering over 2000 sq. km and which provides important habitat for Hawksbills and other turtles, including Chelonia mydas. This area is expected to be sensitive to oil pollution, some of which has already occurred (Meylan, 1984). No figures are available for the extent of incidental catch.

EXPLOITATION

Commodity Panama has long been an important source of tortoiseshell for international trade (Parsons, 1972; Meylan, 1984). Meylan (1984) noted that this was the primary motive for capturing Hawksbills, although the meat and eggs were also widely used. In general the meat of Green Turtles was greatly preferred, and formed an important source of protein for some coastal communities, particularly along the Costa Abajo, a stretch of mainland running from the Valiente Peninsula to Colón; conditions along this coast were not conducive to livestock rearing and transportation of meat from Bocas was reportedly difficult and costly. Hawksbills also had other uses: male reproductive organs are dried and ground and used for a variety of medicinal purposes, including as aphrodisiacs; Guaymí Indians living on the Valiente Peninsula use tortoiseshell to make spurs that are used in cock fights (Meylan, 1984). Ruiz de Guevara (1986) reported that the coastal

Table 155. Exports of tortoiseshell (bekko) from Panama to Japan 1972-86 (kg).
A = taken from Japanese customs statistics;
B = figures from Panama Departamento de Comercio Exterior, quoted in Diaz (1984) (figures quoted in tonnes).
n.a. = not available.
1 = includes some exports to Italy
2 = includes some exports to Netherlands

Year	A	B
1967	n.a.	3000
1968	n.a.	4700
1969	n.a.	5500
1970	n.a.	8100
1971	n.a.	5900
1972	8389	10 900[1]
1973	8990	11 800[2]
1974	9350	6800
1975	9313	8700
1976	5885	6100
1977	4450	3500
1978	6505	2700
1979	4810	2700
1980	3360	1800
1981	3011	1300
1982	2243	n.a.
1983	3889	n.a.
1984	4259	n.a.
1985	1500	n.a.
1986	-	n.a.
Total	75 954	83 500

inhabitants of San Blas regularly keep young turtles in basins and marine enclosures primarily as pets, but occasionally for rearing and eventual sale.

Hunting intensity Hunting intensity for Hawksbill has evidently been, and remains, very high (Carr et al., 1982; Meylan, 1984). Between 1965 and 1983, tortoiseshell estimated to have come from 58 000-96 000 Hawksbills was exported from Panama to Japan; in 1984-85, tortoiseshell equivalent to c. 2300-3800 Hawksbills was similarly exported. The subsistence fishery for the Green Turtle, and that for Hawksbill before the resurgence of commercial demand in the 1960s, was described by Meylan (1984) as "moderately intensive". Capture of Hawksbills for their shell in San Blas was said to be "high and uncontrolled", and the nests were subject to "total plunder" (Ruiz de Guevara, 1986).

Hunting methods Turtles are generally taken with nets, harpoons and by turning on nesting beaches (Carr et al., 1982).

Domestic trade There was said to be a major market for Hawksbill shell in Comarca and the cities of Panama and Colón. In Kuna Yala, several

families have a substantial economic dependence on this commodity (Ruiz de Guevara, 1986).

International trade Panama has been a major supplier of tortoiseshell (bekko) to Japan - according to Japanese customs statistics Panama was the third largest supplier of bekko (after Indonesia and Cuba) during the period 1972-86 (see Table 155).

Panama ratified CITES on 17 August 1978; none of the above trade is recorded in annual reports to CITES. All trade involving Panama recorded by CITES has been to the USA in the years 1980-83 and consists of 26 scientific specimens of Eretmochelys, one shell of Chelonia mydas and 26 skin/leather items and 10 lb (4.5 kg) of "cheloniidae". Colombian boats are said to visit the coastal villages of Kuna Yala and to trade in E. imbricata shell (Ruiz de Guevara, 1986).

PANAMA: PACIFIC

POPULATION: Chelonia mydas

Nesting sites The species is reported to nest (Cornelius, 1981), although no details are available.

Nesting numbers "Very little" nesting by C. mydas is known (Cornelius, 1981).

Trends in nesting numbers No specific information is available, although Cornelius (1981) noted that turtle populations in general had decreased drastically in the previous ten years.

Nesting season Sea turtles in general in Pacific Panama reportedly nest between May and December (source cited in Cornelius, 1981).

Foraging areas No details available; Cornelius (1981) noted that Green Turtles were frequently observed in coastal waters.

Migration Four C. mydas tagged at the Galápagos nesting sites have been recovered in Panamanian waters (see GALAPAGOS account).

POPULATION: Eretmochelys imbricata

It is not clear if the Hawksbill is known to nest; it is said by Cornelius (1981) to be the rarest of the five species which occur "in the coastal waters and beaches of Pacific Panama". No further information is available.

THREATS

No figures are available for the extent of incidental catch; Cornelius (1981) notes that the Pacific Panamanian shrimp fleet, the largest in Middle America, reportedly releases the majority of turtles taken as incidental catch while trawling in the Gulfs of Chiriquí and Panama.

EXPLOITATION

According to Cornelius (1981) there is no industrial exploitation of sea turtles on the Pacific coast of Panama, although coastal villagers are permitted a small subsistence harvest of turtles and small numbers of eggs are harvested illegally.

LEGISLATION

Decreto No. 23, Regulation prescribing urgent measures for the protection and conservation of wildlife 30 January 1967.

The sale or use of meat of all wild animals is prohibited. Collection for scientific purposes requires a permit. All hunting is prohibited for several species, including: *C. mydas*.

Decreto Ejecutivo No. 104, 4 September 1974.

Collection of turtle eggs for domestic use is only permitted between 1 October and 30 April inclusive.

Capture of hatchling turtles is totally prohibited.

Presidential Decree No. 18, 1976.

Trade in wildlife and wildlife products is banned.

Hunting, commerce, imports and exports of indigenous wildlife is prohibited. Decree contains no exception for scientific or educational collection and trade. But Minister has the authority to allow limited export of indigenous wildlife to museums, zoos and scientific institutions.

Resolucion No. 002-80, 24 January 1980.

Prohibits the capture, hunting, purchase, sale or export of 82 endangered species, including:

C. caretta
C. mydas
E. imbricata
L. olivacea
D. coriacea

The collection of eggs in accordance with Decreto Ejecutivo No. 104 is exempted.

POPULATION: Chelonia mydas

Nesting sites This is the most widely distributed and abundant species in PNG (Spring, 1982a). None of the important nesting areas cited by Spring are on the PNG mainland. Most nesting occurs on uninhabited islands, and on islands where meat in general is not eaten (in Seventh Day Adventist areas) or turtle meat in particular is not eaten (in the Trobriand Islands). Notable nesting sites include: in Manus Province, the Sabben, Los Reyes, Purdy, Kaniet, and Anchorite Islands (all uninhabited), the Hermit Islands, the Ninigo Island and Lou Island (SDA); Mussau Island (SDA) in New Ireland Province; and Tuma, Munuwata, and Simlindon in the Trobriand Islands, Milne Bay Province. Long Island, in Madang Province, also holds important numbers of nesting turtles (Spring, 1980b, 1982a and 1983).

Nesting numbers Virtually no quantitative information is available to supplement the impression of relative abundance given by Spring (1982a). The exception concerns Long Island, where turtles use a beach some 12 km long around the northern margin of the island; 332 nesting females were tagged here in 12 months between July 1980 and August 1981 (Spring, 1983). It is not entirely clear whether all turtles seen nesting were tagged, although the implication is that most were, and not all the beach was regularly patrolled, although the zone of highest nesting appears to have been. While at least 1000 turtles are consumed on Long Island a year, not all of these will have been turned on the beach. It seems likely that annual nesting numbers here are at least a few hundred. Long Island has been regarded as one of the largest C. mydas rookeries in PNG (Pritchard, 1979a).

If numbers are similar at some of the several other sites mentioned by Spring (1982a), although this cannot be properly assessed, one or two thousand C. mydas may nest annually in Papua New Guinea. Whilst this figure cannot be substantiated at present, the total is unlikely to be much lower and is likely to be significantly higher.

Trends in nesting numbers No detailed information is available, but according to Spring (1982a) nesting sites near villages have generally declined in importance or been abandoned. In some SDA areas, turtle populations are believed to have increased over the past 30-50 years (Spring, 1980b). No data are at hand on the number of such sites. Pritchard (1979a) suggests that PNG turtle populations are probably significantly depleted in most areas, while admitting the lack of hard data to substantiate such a claim. Decline is attributed to excessive exploitation coincident with breakdown of traditional taboos and management practices, and the spread of improved technology and cash economies.

Nesting season At some sites, e.g. Long Island, some nesting occurs virtually throughout the year; it is reportedly more seasonal at others, e.g. May-September in the Ninigo Islands, March-April in islands near Kiriwina (Spring, 1982a).

Foraging sites Suitable feeding grounds appear to be widespread. Spring (1982a) highlights one such area, comprising 20 sq. miles (52 sq. km) of shallow water with seagrass and coral, between Losuia and Vakuta in the Trobriands. Crown Island, near Long Island (Madang) is also reportedly an important feeding area for juvenile turtles (Spring, 1983).

Migration Of 14 recoveries out of 332 females tagged on Long Island, five have been recaptured in north-west Irian Jaya (and the nine remaining

from West Sepik Province, Manus Province, and Madang Province in PNG) (Spring, 1983).

POPULATION: Eretmochelys imbricata

Nesting sites The species is almost as widespread as C. mydas, and appears to nest in the same areas in lower densities (Spring, 1982a). Nesting is known at several points around the mainland, both the Gulf and northern coasts, and is widespread in the islands, notably on Manus and smaller islands in Manus Province, and Kiriwina and nearby islands in the Trobriand group.

Nesting numbers No quantitative data are available. The species, while generally less abundant than C. mydas, is reportedly more so on Lou Island (Manus Province) and Kairuru (East Sepik Province), and of equal abundance in the Woodlark Islands (Spring, 1982a). The only more detailed information concerns Long Island (Madang Province), where "very few" females were seen to nest during a 12-month survey and only one was tagged. The species is said to "nest in numbers" on Raboin, off the tip of Cape Wom, East Sepik Province (Spring, 1982a).

Trends in nesting numbers Turtles in general are reportedly declining in numbers in PNG wherever they are hunted (Spring, 1982b), or are suspected to be declining (Pritchard, 1979a); Hawksbills are hunted, apparently mainly for food and for tortoiseshell, and presumably would be subject to this decline. There are no data available to substantiate this reported trend.

Nesting season On Long Island, local villagers reported that E. imbricata nesting occurs throughout the year, although it was observed only in May-July (Spring, 1983); nesting is said to be between May and September in East Sepik Province, March-April in the Trobriands, and June-August in Manus Province (Spring, 1982a).

Foraging sites Suitable foraging areas, with coral reef zones, appear to be widespread in the country, and Hawksbills are to be found wherever well-developed coral reefs are present (Pritchard, 1979a); no information is at hand on particularly favoured sites.

Migration Little information is available. One female tagged on Kerehikapa (Solomon Is.) on 5 December 1976 was slaughtered 1400 km distant at Fisherman's Island, Central Province, PNG in February 1979 (Vaughan and Spring, 1980). Thus some Hawksbills in PNG waters may breed elsewhere.

EXPLOITATION

Commodity Sea turtles are widely exploited in Papua New Guinea for meat and eggs. All species are eaten to some extent, but C. mydas is the most popular; E. imbricata, though eaten less often, is also widely consumed; however there are a few recorded cases of poisoning. The shell is used for carving traditional ornaments and various household items. The raw shell is not commonly traded although traditional tortoiseshell ornaments are used in traditional exchanges and may be passed on as heirlooms. In some areas there was a tradition that turtle blood had a tonic effect, improving stamina and diving ability. Several islands have been converted to the Seventh Day Adventist faith and, on these, turtles are not generally eaten (Spring, 1982b).

Hunting intensity One of the main areas for turtle fishing is the Torres Strait, the meat being sold in the Daru Market. Interviews with fishermen in Daru from October 1984 to January 1985 revealed a total catch of 357 turtles over four months, mostly from the Warrior Reef complex. The sex ratio of the catch was highly skewed, with 92% females, owing to selective hunting, the females being preferred for eating. An average of 2.27 turtles were caught per boat per day, fluctuating from 3.01 in November to 1.74 in December (Prescott, 1986). Eley (1986) estimated that a total of 2000 turtles a year were sold in Daru, with a smaller number sold or distributed within nearby villages.

Estimates of harvests elsewhere are less complete. Eaton and Sinclair (1981) found that a total of 874 female Green Turtles had been killed at Koki Market, Port Moresby, over a two-year period starting in January 1979. Although Spring (1982a) said that 133 were sold in Koki Market in March 1979 alone. Spring (1983) quoted numbers of turtles killed by villagers for local consumption on Long Island (Madang Province), an island with few traditional restraints on turtle hunting. At six of the nine villages known to be involved in turtle hunting, between 1096 and 1405 turtles were estimated to be killed each year. Some turtles are known to be killed on this island for sale on the mainland by visiting fishermen and in 1970 it was estimated that 329 were caught for this purpose.

Trawler crews are reported to catch turtles on other islands; on Pisin Island (near Hermit), up to 120 turtles a year may be taken in this way for sale in Manus (Pritchard, 1979a).

In Western New Britain, a community of 166 inhabitants in the Garu Wildlife Management Area, was estimated to harvest 74 turtles and to collect 5233 turtle eggs annually. In the Tonda Wildlife Management Area, a community of 920 people was said to kill 163 turtles a year (Liem et al., 1976).

In some parts of PNG turtles are never, or only rarely, eaten. These include Seventh Day Adventist areas, such as the Hermit Islands, the Ninigio Islands, Lou Island (Manus) and Mussau Island (New Ireland). The Trobriand Islanders avoid turtles for cultural reasons (Spring, 1982a).

Several authors have implied that the harvest of Hawksbill Turtles is relatively small (e.g. Spring, 1982b; Prescott, 1986), but in the two years from January 1979, a total of 83 Hawksbills were sold in Koki Market, Port Moresby. This represented about 9% of the number of Green Turtles sold over the same period (Eaton and Sinclair, 1981).

There are very few indications of the scale of turtle egg collection in PNG. Spring (1983) found that at Point Kiau (Long Island, Mandang Province) about 25 nests a week were eaten. At Garu, Wetern New Britain, about 5000 eggs a year were consumed by a community of 166 (Liem, 1976).

Hunting methods Spring (1982b) gave a good description of the traditional methods of hunting employed in PNG. The most widely used method is harpooning, either with a fixed tip or a detachable tip, from a canoe. In the Western Province, it used to be the custom to build a platform over the reef from which to harpoon turtles and dugongs, but this is no longer practised. Another method which is falling into disuse is netting using traditional materials; this involved a large hunting party comprising several canoes and 24 men. In various islands, turtles are normally caught by hand at sea. Traditional turtle hunting is normally associated with preparing turtles for feasts, and is accompanied by much ceremony and

involves many taboos (Spring, 1982b). The catching of nesting females on the beaches is increasingly being practised, but it does not appear to have been a widespread traditional technique. Pritchard (1979a) described a complex system which is used in some areas of determining, from the numbers of eggs laid, when the female will return to nest. He concluded that it had no practical value.

The modern, commercial method of fishing around Daru is with harpoons from boats, often powered by outboard motors or inboard diesel engines. The main vessels used are double-outrigger sailing canoes with auxiliary outboards (Prescott, 1986).

Historical trends In former times, the hunting of turtles was limited both by the small human population and by the strong taboos and traditions surrounding their capture. These traditions are gradually being abandoned, and the introduction of commercial sales of turtle meat in towns has inevitably increased the hunting pressure (Spring, 1981 and 1982b). Turtle meat is becoming a common item of diet in Daru, and the prohibition of commercial sale of Dugongs in 1984 intensified the hunting pressure on turtles as the fishermen switched to turtles as an alternative prey (Eley, 1986). Exceptions to the generally increasing trend of turtle harvests are found in areas where the majority of the population are Seventh Day Adventists. Here, harvests are thought to have declined over a period of 30-50 years and, in some cases, stopped altogether (Spring, 1982a).

In the Manus Province, Hawksbills used to be caught for the sale of their carapace to Japanese and European tourists, but the export restrictions have meant that it is now more difficult for the tourists to take shell out of the country, there is therefore less demand for shell (Spring, 1980b), and this may have reduced the hunting pressure. Eley (1986) noted that the carving of combs and jewellery was just beginning in Daru, although it was not traditional in the area.

Domestic trade Turtle meat is sold in several markets and towns throughout PNG. These include Port Moresby (Koki Market), Daru, Mandang, Bogia, Saidor, Kupiano, Lorengau, Kieta, Misima Island and Talasea (Pritchard, 1979a). One of the main markets is in Daru, where they are regularly sold, and turtle has now become an everyday food item. During a survey from October 1984 to January 1985, the average price per turtle fell from K42.60 to K28.03, with a mean of K33.90 for the four months (K1 = US$1.05). After allowing for the costs of running the boats and the average time needed to catch one turtle, this gave a mean profit of K63.68 a day for each boat (Prescott, 1986). Spring (1982a) said that the greater demand and the lesser supply of turtles at Port Moresby resulted in a higher price than in Daru. She quoted prices for an adult female <u>C. mydas</u> of US$90-115 at Port Moresby and US$15-30 at Daru in 1979. Eaton and Sinclair (1981) found that the average price of turtles in Koki market, Port Moresby, was about K41. Liem (1976) quoted estimates of the cash value of turtle meat and eggs consumed in New Britain in 1973/74, which valued meat at $0.50 a kg and eggs at $0.02 each. Turtle meat was the same value as Dugong meat, five times the value of fish and half the value of wild pig.

International trade CITES Annual Reports contain no evidence of substantial trade in turtle products directly from PNG, but only sporadic exports of tourist items. These are shown in Table 156. In 1981, Italy reported exporting 54 leather items to F.R. Germany and 110 handbags to Japan made of <u>C. mydas</u> leather said to have originated in PNG.

PAPUA NEW GUINEA

The Customs reports consulted do not contain any record of trade in tortoiseshell with PNG.

Table 156. All trade in *C. mydas*, *E. imbricata* or unspecified sea turtle products from PNG recorded in CITES Annual Reports since 1976. All were reported as exports from PNG to the country shown, except those where the importing country (underlined) reported imports from PNG. AU = Australia, NZ = New Zealand.

	Cheloniidae	*C. mydas*	*E. imbricata*
1985		1 shell NZ	
1984	1 shell Japan		
1983		1 shell AU	
1982	1 shell <u>AU</u> 2 leather items <u>USA</u>		
1981		1 unspecified <u>USA</u>	
1980	1 shell <u>UK</u>	1 carving <u>USA</u>	4 carvings <u>USA</u>
1979		3 shells AU	1 body AU
1978	1 body AU 4 shells AU 1 shell NZ 1 skull USA	1 body <u>AU</u>	4 bodies <u>AU</u> 5 shells AU 3 leather items AU 1 leather item UK 4 shells UK
1977		1 shell AU 1 unspecified AU 1 skull USA	9 bodies AU 1 shell AU 3 unspecified AU 1 unspecified USA

RANCHING

No sea turtle ranches have yet been set up in PNG, but a Japanese company made preliminary enquiries to the Government with a view to establishing one. In the event, no formal proposal was made (D. Kwan *in litt.*, 2 December 1986).

LEGISLATION

Papua New Guinea acceded to CITES on 12 December 1975.

Collection, export, research and filming involving wildlife; list of protected and restricted species. (The list was reproduced from a leaflet published by the Department of Natural Resources of Papua New Guinea dated 26 February 1976).

Trade in the following sea turtles is regulated. Export of only restricted numbers is allowed and detailed reasons are needed for the export of more than four specimens. An export permit is required.

C. caretta
C. depressa
C. mydas
E. imbricata
L. olivacea
D. coriacea

Fauna Protection and Control Act, 1966.

D. coriacea is declared a national animal.

Green Turtles have never been proved to nest in Peru. Some sea turtle nests occur, particularly in the north at Punta Malgo and occasionally further south, but the only species to be identified has been L. olivacea. C. mydas is frequently sighted feeding in offshore areas along the northern section of the coast from Lagunillas northwards. Of the C. mydas caught off Pisco 89% have been immature, suggesting that this is a developmental habitat. There are only five records of E. imbricata carapaces from Peru (Brown and Brown, 1982).

EXPLOITATION

Commodity Green Turtles are a popular food source in coastal Peru, and virtually all of the meat and internal organs are consumed. Oil is extracted from the fat, and is believed to cure bronchial problems; and the blood is drunk as a general tonic. Skin is sold to a company in Lima, and the carapaces are used for a variety of decorative purposes and to serve as functional bowls. Very rarely are carapaces of E. imbricata found (Brown and Brown, 1982).

Hunting intensity The south of the country is the main area for turtle hunting, especially the port of Pisco. Reportedly, 7-10 turtle boats operated out of the port, making trips of 2-3 days' duration. The peak of the turtle fishing season is December-April, when up to 70 C. mydas can be seen awaiting slaughter, the average catch being 10-30 a day at this time. C. mydas forms the bulk of the catch, but about 200 D. coriacea are also caught each year. Official statistics for the turtle harvest are given in Table 157 (Brown and Brown, 1982).

Table 157. Catch statistics of marine turtles in Peru (in t). Data for 1972 to 1979 were read off a graph in Brown and Brown (1982); 1980-1985 from Ministerio de Pesqueria (in litt., 16 October 1986).

Year	1972	'73	'74	'75	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85
t	140	70	50	150	200	35	300		58	44	28	15	-	36

Hunting methods In the north of the country, most turtles are caught incidentally by fishing nets and shrimp trawlers. However, in the south, there is a specialised turtle fishery using tangle nets (Brown and Brown, 1982). The turtles are normally kept live on shore until they are sold (Frazier and Salas, 1983).

Historical trends There are no indications of the historical levels of turtle harvest in Peru, although Frazier and Salas (1983) described it as a "great tradition". Some of the fluctuations in the harvest of turtles shown in Table 157 have been attributed to the greater southward extent of warm water associated with El Niño in some years. The rise in 1978 is thought to be partially because the statistics were more diligently collected after the passing of new legislation in 1977 (Brown and Brown, 1982).

Domestic trade In the north of the country, most of the turtles are consumed by the fishermen, but some are sold to itinerant turtle buyers, who take them to sell at markets in La Cruz, Piura and Chiclayo. Meat is sometimes frozen for transport to Lima. Pisco is said to be one of the few

ports where the turtle protection laws are enforced. Most turtles are landed surreptitiously at night and butchered at dawn. They are sold to a "Tortuguera", who specialises in selling turtle products. Meat sells for US$2 a kg, approximately half the price of beef (Brown and Brown, 1982). Frazier and Salas (1983) asserted that there was no market for turtle skin in Peru, in contrast to Brown and Brown (1982), who indicated a leather company in Lima active in this field.

International trade Virtually all of the turtles landed in Peru are consumed within the country and little, if anything, is exported.

Peru ratified CITES on 27 June 1975. The only record of trade from Peru in the CITES Annual Reports was the import to the USA of a total of five shells of C. mydas between 1981 and 1983. The Customs reports consulted contain no record of any trade in turtle products with Peru.

LEGISLATION

Prohibition of the capture of two species of turtles in some islands and coastal points, 31 December 1976.

The taking of D. coriacea schlegeli is completely prohibited. The taking of C. mydas agassizi ashore is prohibited on a large number of islands and coastal areas listed in this regulation. The taking of this species at sea is only allowed in respect of turtles larger than 80 cm.

Ministerial Resolution on classification of species of Fauna and Flora, 30 September 1977.

The following species are classified as vulnerable by the Ministerial Resolution: C. caretta, C. mydas, E. imbricata, L. olivacea and D. coriacea

POPULATION: Chelonia mydas

Nesting sites Most sea turtle nesting occurs in the islands and archipelagos fringing the Sulu Sea; this area also constitutes the main non-nesting range of sea turtles in the Philippines (Alcala and White, 1981; White, 1981). The principal nesting site is the Turtle Islands group, shared with Sabah, in the southern Sulu Sea. Turtle Islands in Philippines territory are Baguan and Taganak (these two with most nesting), Langawan, Bakkungan Besar, Lihiman, Boauan and Sibaong (no nesting); the group lies within Tawi-Tawi Province. The second most important C. mydas rookery is reportedly the San Miguel Islands, also in Tawi-Tawi (G.P. Reyes in litt., 23 September 1986). Although information is sparse, some nesting is likely to occur widely within both the Palawan and Sulu Archipelagos. It is known to occur on Palawan itself and on certain nearby islands, primarily the Quiniluban portion of the Cuyo group in the northern Sulu Sea. Main sites in the Quiniluban group are Tayay, Pamalikan, Mandit and Halog (although this last is used mostly by E. imbricata) (Matillano and Ladra, 1986). Nesting is also reported in southern Negros (Alcala and White, 1981) and may occur more widely in the central Visayas.

Nesting numbers Virtually the only recent information available comprises egg production figures for the Turtle Islands collected by Task Force Pawikan (G.P. Reyes in litt., 23 September 1986). The estimated numbers of eggs produced on the five main turtle islands are given in Table 158. Limpus (1985) also noted that a small number of eggs, approximately 25 000 a year, are laid on Boan.

Few data are available for sites outside the Turtle Islands. Matillano and Ladra (1986) recorded only 6, 7, 4 and 32 nests, respectively, on Mandit, Tayay, Pamalikan and Halog, in the Quiniluban group during surveys between May 1981 and September 1984. Despite the reported relative frequency of C. mydas in Quiniluban waters, nesting (based on the recorded data) appears to be of little significance.

Table 158. Egg yield on the three most productive Turtle Islands, for the three months of peak egg production (generally July, August and September), based on 1951 data collected by Domantay (1953:19).

	Daily egg yield	Monthly egg yield
Baguan	5,333	160,000
Taganak	4,000	120,000
Langawan	1,500	45,000

Trends in nesting numbers Virtually all workers, e.g. Alcala and White (1981), White (1981), de Celis (1982), Fontanilla (1979), Fontanilla and de Celis (1978), Limpus (1985), state or imply that sea turtle populations in the Philippines have greatly declined in recent years and remain in significant numbers only around the Turtle Islands. These statements appear to be based partly on general impressions of relative abundance and on the increasing effort necessary to catch turtles. Domantay (1953), who collected information in the immediate post-war period, reported that egg yields at his time of writing were significantly lower than before World

War II, when the islands were administered under British North Borneo. Information presented by Domantay (Table 160) is based in part on 1947-1951 records from the local Deputy Treasurer and in part on records gathered personally on a six-week visit in 1951. He stressed that the 1947-1951 information was incomplete because numerous additional eggs were consumed by the collectors, the army and local officials. He also reported that Baguan and Taganak were by far the most productive islands, with Langawan a poor third; the remainder were only marginally productive in economic terms.

Table 159. Mean daily nesting on Taganak and Baguan recorded between 8 August and 11 September 1951 (Domantay, 1953) compared with recent data from Task Force Pawikan (Reyes in litt., 1986). * The 1951 Baguan figure is an approximation derived from yield and revenue data.

	Taganak			Baguan		
	Eggs laid	Nests. laid.	Nests/ night	Eggs laid	Nests. laid.	Nests/ night
1951						
8 Aug-11 Sep	137254	1352	39.8			53 *
1983						
Aug	9876	94	3.0			
Sep	28071	267	8.90			
1984						
Aug	16010	152	4.9		628	20.2
Sep	11740	112	3.7		605	19.5
1985						
13 June-19 July				34169	324	8.76
Aug	12410	148	5.69			
Sep	17680	242	9.31			

Table 160. Estimated annual egg production in the Turtle Islands, from Reyes (in litt., 1986), with average annual egg harvest from the three main islands for 1951, based on estimates by Domantay (1953).

	1951	1984	1985
Baguan	788 162	407 941	408 197
Taganak	591 121	114 949	143 377
Langawan	221 670	274 261	142 646
Lihiman		173 616	119 465
Bakkungan Besar		36 149	13 778
Total	1 401 450	1 006 916	827 463

The best quantitative comparative data available are the estimates of the numbers of eggs laid per night in the peak season (Table 159); these appear to demonstrate a severe decline in nesting effort. The data for 1984 are

ambiguous. Reyes (in litt., 23 September 1986) cites two sets of figures for the egg production on Taganak; one gives the number of clutches per night in August and September respectively as 8.37 and 6.18, and the other (shown in Table 159) as 4.9 and 3.7. Similarly, there is confusion over the number of nests on Baguan in 1984; at one point, the total numbers of clutches produced in August and September were said to be 628 and 605 respectively (Table 159), while elsewhere Reyes reported that only 384 nests were laid on Baguan between 19 July 1984 and 4 September 1984, giving a mean of only eight nests per night. Numbers of nests per night on Taganak in the early 1980s are only around 14-16% (depending on which set of 1984 figures are used) of those in 1951; numbers on Baguan are 17-38% of those in 1951 (depending on which of two sets of figures are used).

On the other hand, the total annual egg production in the islands in 1984 (Table 160) appears to have fallen only by 30% since 1951, but this is probably misleading. The 1984 figures are based on nest counts, and represent the total numbers of eggs laid, whereas the figures for 1951 are extrapolated from the numbers of eggs harvested on only one island in one month. The numbers of nests per night (Table 159) probably give a better estimate of the declines in turtle populations.

Nesting season According to Domantay (1953), some nesting occurs throughout the year in the Turtle Islands, but most is May-September, usually with a peak in August; while five females may nest nightly on Taganak in January, 65 may nest nightly in August. Limpus (1985) quoted figures which indicated that 45% of the nests on Baguan were laid in August-October. Most nesting in the Quiniluban group is November-March, during the north-east monsoon (which minimises human disturbance) (Matillano and Ladra, 1986).

Foraging sites Little information is available, but the Turtle Islands are rich in suitable lagoons, coral reefs and beds of aquatic vegetation (reportedly algae, not seagrass) and good numbers of C. mydas appear to forage in the area (Domantay, 1953). It is not clear if there is a resident population here, or if foraging turtles and nesting turtles in the area are from different populations. Similarly, the Quiniluban Islands provide extensive foraging grounds, with algae and seagrasses present; most C. mydas observed here were immatures (Matillano and Ladra, 1986).

Two of ten sub-adult C. mydas captured at sea over presumed foraging grounds in the Quiniluban group, tagged and released, have been recovered subsequently; they had grown some 20-27 cm in 16 months (Matillano and Ladra, 1986).

Migration Little information is available. Some tagged turtles have been shown to move between the Philippines and Sabah portions of the Turtle Islands group on subsequent nestings in one season. Several C. mydas tagged while nesting in the Sabah Turtle Islands have been recaptured in the Philippines, mainly around the central group of islands (de Silva, 1986). Two females, first tagged on P. Taganak in the Philippines, were recovered nesting in the Turtle Islands N.P., Sabah, Malaysia. One was tagged on 9 September 1982 and nested on Bakkungan Kecil on 10 September 1982, the other was tagged on 9 October 1982 and nested on P. Selingaan on 17 November 1982; both islands are around 29 km from Taganak.

POPULATION: Eretmochelys imbricata

Nesting sites The species occurs within the same region favoured by C. mydas, namely, the islands and archipelagos fringing the Sulu Sea, from the Visayas in the north, to the Turtle Islands in the South. Within this region, E. imbricata nests mainly on the more remote and least disturbed islands, but also to some extent on inhabited beaches. Numbers are very low in the Turtle Islands (Domantay, 1953) moderate in the Quiniluban group (Matillano and Ladra, 1986), with scattered nesting in the Visayas, including southern Negros, and Sumilon (Alcala, 1979). Sporadic nesting is also likely to occur in the Palawan and Sulu Archipelagos.

Nesting numbers Alcala (1979) reported seven confirmed (or attempted) nestings in the Visayas in 1978-1980, mainly in southern Negros, with a further 22 reported (on six of the seven confirmed nesting attempts the female was slaughtered). Domantay (1953) reported that only six out of 1352 nests he counted over six weeks in the Turtle Islands were by E. imbricata. Matillano and Ladra (1986) report significant nesting in the Quiniluban group, off north-east Palawan, mainly on Halog (32 nests confirmed during surveys May 1981-September 1984). Nesting numbers in the Philippines appear to be very low, although sparse nesting may be more widespread than is presently known; many areas remain to be surveyed.

Trends in nesting numbers No quantitative data are available (other than for the Turtle Islands, where Hawksbills make up an insignificant proportion of the total nesting). Most authorities (Alcala, 1979; Alcala and White, 1981; White, 1981; de Celis, 1982; Matillano and Ladra, 1986) state that sea turtle populations, including E. imbricata, have declined greatly in the Philippines; effort per unit catch or per unit of eggs harvested has greatly increased in parallel (de Celis, 1982). Hawksbill decline is attributed to exploitation for shell, meat and eggs (Alcala, 1979).

Nesting season Seven nesting attempts in the central Visayas were in February, April, May (2), July (2) and November (Alcala, 1979). Nesting in the Quiniluban group, including by C. mydas and E. imbricata, is reportedly in November-March, during the north-east monsoon, with a peak (species uncertain) in December-February (Matillano and Ladra, 1986).

Foraging sites Hawksbills were seen at night in coral crevices in the Quiniluban group, and may be presumed to feed in the area (Matillano and Ladra, 1986); the same applies to the central Visayas. Suitable foraging sites would seem to be quite widespread in the Philippines.

Migration No information. Recaptured individuals tagged in the central Visayas were taken in the same general area, or up to 60 km distant (it is uncertain if this figure refers to C. mydas or E. imbricata). One female tagged on Bakkungan Kecil, one of the Sabah Turtle Islands, was recovered 40 days later and 713 km distant in the central Philippines (de Silva, 1982).

EXPLOITATION

Commodity Sea turtles are exploited throughout the Philippines for meat, eggs, hide, shell and for stuffing as curios (Alcala, 1980). Blood and liver are used locally as a cure for asthma. There are records of turtle poisoning attributed to E. imbricata and also C. mydas (de Celis, 1982).

Hunting intensity In spite of legal protection, both turtles and their eggs are still caught and collected in the Philippines. Alcala (1980) concluded that "it is probably safe to state that most, if not virtually all, nesting turtles in Central Visayas end up on the table and in souvenir shops. There is reason to believe that a similar situation exists throughout the Philippines". Six out of seven of the E. imbricata observed nesting were slaughtered on the beach. White (1981) concluded that it was not the protective legislation but the rarity of turtles which was limiting their commercial exploitation.

Catches of turtles in the shallow waters around the Philippines (= Municipal waters) are listed in Table 161. In recent years, these probably represent accidental catch. Other statistics of landings throughout Philippine waters (Table 162) also indicate that substantial quantities of turtles are landed.

Table 161. Turtle catches in Municipal Waters (= within 7 km of the shore and less than 7 fathoms (12.8 m) in depth) around the Philippines from 1976 to 1983. Catches in metric tonnes, compiled from Fisheries Statistics by F.S. Matillano (in litt., 5 January 1987).

1976	1977	1978	1979	1980	1981	1982	1983
57	268	182	40	150	36	3	3

Table 162. Quantities of turtle shell of all species gathered throughout Phillipine Territorial waters 1971-1982. Based on the Auxiliary Invoice of the Bureau of Fisheries and Aquatic Resources, compiled by F.S. Matillano (in litt., 5 January 1987).

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
kg	–	–	843	4	1110	1170	–	9589	–	13346	8060	610
Pesos	–	–	4227	40	3705	30077	–	15921	–	35185	24720	4150

The current level of collection of eggs was reported by Limpus (1985). On Baguan, commercial collection is prohibited but an estimated 10% of all eggs laid, i.e. around 40 000 eggs, is used as payment for local labour and boat hire. On the remaining Turtle Islands, Taganak, Langawan, Lihiman and Bakkungan Besar, there is a closed season January-March and outside this season 70% of the eggs are collected, the remaining 30% being protected. this gives an estimated official harvest of over 380 000 eggs. In addition to the officially approved harvest, Limpus reported that there was substantial illegal collection. On Boaan, all of the eggs laid (approximately 25 000) are collected; there is some collection of eggs on Baguan by visiting fishermen; on Langawan, Lihiman, Bakkungan Besar and probably Taganak, there is no supervision during the close season and most of the eggs are thought to be collected by the locals (approximately 100 000 eggs). During the open season, additional eggs are collected by locals which are not included in the official statistics. The total egg harvest is thus thought to be in excess of half a million eggs a year, i.e. over half of the eggs laid. De Silva (1984) also reported that egg collection on

Tanganak and Bakkungan Besar (Turtle Islands) was not controlled. Some collection of eggs by visiting fishermen is reported on Halog Island (Cuyo Islands) (Rodriguez, 1984).

Hunting methods Throughout the central Visayas, turtles are actively sought by fishermen, who catch them by spearing, nets and fish corrals. Animals caught accidentally are rarely released alive (Alcala, 1980). Around Camiguin Island, fishermen occasionally catch turtles with spearguns (Fontanilla and de Celis, 1978).

Domantay (1953) gave a description of the egg collection methods in operation after the War. Labourers were stationed on the three main Turtle Islands (Tanganak, Baguan and Langawan) to collect the eggs, which they did by probing the sand each morning, usually 6-9 a.m. At least twice a week they made visits to the other less productive islets to search for eggs. Several nests were missed by the collectors, particularly those laid further inland, but these were more susceptible to natural predation. The eggs were usually dried in the sun and then transported for sale mainly in Tanganak. An annual closed season was imposed from 1 May to 31 August on each of the seven Turtle Islands in turn, in spite of the fact that only three produced commercial quantities of eggs. Thus the season was only effective in three years out of seven.

Historical trends The Turtle Islands were leased to the British North Borneo Company by the Sultan of Sulu in 1678. They became part of the Philippines by the Treaty of Paris, 1898, but continued to be administered by the British until 1947. Domantay (1953) quoted figures calculated from the Deputy Treasurer's records which showed that the numbers of eggs collected in the Turtle Islands were 724 001, 433 223 and 963 437 in 1948, 1949 and 1950 respectively. However he cautioned that these figures were unrealistically low as they did not take into account the local consumption by the collectors, and estimated that the annual collection was about 1 401 450 eggs. Using the estimates of revenue provided, it is possible to assign this to the three main islands in the proportions shown in Table 160. Domantay said that the revenue from egg collection in 1951 was "far below the pre-war production" but that this was only due in part to a decline in turtle numbers and in part to inefficiency in collecting the revenue and other factors. Other aspects of the trends in egg yield are discussed under "Trends in nesting numbers". The collection of eggs on the Turtle Islands has continued until the present. An Order prohibiting collection in 1982 has apparently been superseded or is not enforced.

There are early reports (1624, cited in White, 1981) which indicate that an extensive Hawksbill shell fishery once flourished in the Philippines. Seale (1971, cited in Gomez, 1979) estimated that 8000 kg of tortoiseshell were gathered annually in the Philippines. During 1914, 2296 kg were exported from Mindanao and Sulu alone. The occupying Japanese forces during World War II killed many turtles, the total being estimated at "no less than 20 000 to 25 000" (Domantay, 1953). Fontanilla and de Celis (1978) reported that fishermen had noticed declining catches of turtles, particularly around Davao del Sur. A survey in the southern Sulu Sea (Datuin, 1979, cited in de Celis, 1982) revealed that over the previous five years, each fisherman had caught on average one or fewer turtles a day, whereas previously four a day had been a more usual catch. De Silva (1982) indicated that Filipino fishermen and traders were active in catching and purchasing turtles (mostly E. imbricata) in the waters around Sabah, and within the Philippine territory. Polunin (1975) quoted an estimate that 5000 large C. mydas were captured annually in the Sulu sea. De Celis (1982) claimed that the

stuffing industry in Zamboanga City alone used 2000 E. imbricata and almost as many C. mydas a year. Limpus (1985) noted that there was a trend in this stuffing industry towards using smaller turtles in recent years, indicating a possible decline in the availability of large turtles.

Domestic trade Turtle meat and eggs are said to be no longer sold openly in Zamboanga City, although restaurants in Cebu City were still offering turtle dishes (Rodriguez, 1984). A few turtles are sold as tourist items (Alcala and White, 1981), and a full-scale cottage industry for stuffung turtles operated in Cebu City, Mindoro and Zamboanga in 1977. Limpus (1985) confirmed that this industry still continued, specialising in the tourist and export market. Prices quoted for turtle products in Zamboanga in 1979 were: meat, US$0.50 a kg; bones, US$0.25 a kg; Hawksbill shell, US$25 a kg; and eggs, three for US$0.03 (de Celis, 1982).

International trade Exports of tortoiseshell were reported in the Customs statistics of the Philippines until 1982. These are shown in Table 163. Imports of raw tortoiseshell from the Philippines are also reported in the Customs statistics of the importing countries, and these are shown in Table 164. Both these tables indicate that the Philippines have been a major exporter of tortoiseshell, most of which goes to Japan, although the levels appear to have fallen in recent years. Japan's import statistics indicate that, with the exception of 1974, most of the shell was of E. imbricata.

Philippines Customs statistics also report exports of worked tortoiseshell items, and these are shown in Table 165. The majority of the exports were to Japan. Imports of worked tortoiseshell to Japan are also shown in Table 165. Formerly, there were large quantities of worked bekko, but recently, more has been classified as "worked tortoiseshell and articles thereof not elsewhere specified", indicating that it is not the shell of E. imbricata, but probably of C. mydas.

Turtle eggs are also exported to Sabah, Malaysia, in substantial quantities. There is a large market for turtle eggs in Sandakan which, since the prevention of egg collection on the Malaysian Turtle Islands, is supplied mainly with eggs from the Philippine islands (de Silva, 1984; F.S. Matillano in litt., 23 January 1987).

Japanese Customs reports indicate that the Philippines has been one of the main sources of turtle skins. The quantities are shown in Table 166. There is no indication of what species of turtle was involved.

CITES Reports indicate that the Philippines was one of the major sources of sea turtle products intercepted on import into the USA. Most were reported as bodies, shells or carvings, but are recorded together in Table 167 as "items". A few other transactions were also recorded.

RANCHING

Task Force Pawikan maintains hatcheries on the Turtle Islands comprising fenced-off sections of beach, covered with chicken wire. During 1983, more than 13 300 eggs were transferred to the hatcheries. Hatching success rates

are normally 80-85%. Most of the hatchlings are released immediately, but a small percentage are taken to a rearing pond in Zamboanga City, where they

Table 163. Destinations of all exports of raw tortoiseshell reported in Philippines Customs statistics. All weights in kg (Wells, 1979; Luxmoore and Canin, 1985).

Destin'on	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
France	0	0	0	0	0	0	0	46	0	0	0
Fr.Pacific I.	0	0	0	0	425	352	150	0	0	0	0
H. Kong	0	0	0	0	0	0	0	68	0	0	0
Italy	0	0	0	0	740	25	384	110	100	300	0
Japan	1243	7100	21363	8316	13372	18286	18092	6560	348	0	0
Okinawa	0	0	0	0	600	7979	11755	1404	0	0	8820
S'pore	0	0	100	0	0	0	0	5	0	0	0
Switz'd	0	0	0	0	0	0	0	40	0	0	0
Taiwan	0	0	0	0	0	1269	7600	5278	1013	0	0
USA	0	0	0	0	470	0	164	0	0	0	0
Total	1243	7100	21463	8316	15607	27905	38145	13511	1461	300	8820

Table 164. Imports of raw tortoiseshell from the Philippines reported in the Customs statistics of importing countries. All weights in kg. 0 = no imports reported; - = Customs reports not available.

Importer	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
H. Kong	375	100	72	0	0	0	0	0	0	0	0	0	-
Italy	0	320	1094	1400	-	-	-	-	-	-	-	-	-
Japan Bekko	4261	1288	2369	3313	1416	3539	2514	1439	1376	232	1227	276	0
" Other	12301	200	791	0	23	157	1214	20	0	0	0	-	-
S'pore	341	0	0	0	0	-	-	-	-	-	-	-	-
Taiwan	0	0	5475	2230	930	1524	190	0	0	0	-	-	-

Table 165. Exports of worked tortoiseshell reported in Philippines Customs statistics. All quantities in numbers of pieces, values converted to US$ (Canin and Luxmoore, 1985). Imports from the Philippines reported in Japanese Customs statistics of worked bekko and "worked tortoiseshell and articles thereof not elsewhere specified" (in kg) are also given.

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Pieces	24330	11615	7835	36006	22953	4547	5820	3008		
US$	23630	64306	95524	242282	80109	13672	2781	1955		
Japanese Imports (kg)										
Bekko	1373	740	727	1618	936	0	0	0	0	0
Other	1599	6693	5454	9276	7919	7511	1989	4072	0	0

Table 166. Imports of "Turtle skins" (kg) from the Philippines reported in Japanese Customs Statistics.

1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
18610	6408	3857	4300	7531	0	625	2988	0	0

Table 167. All trade in *C. mydas*, *E. imbricata* or unspecified sea turtle products involving the Phillipines recorded in CITES Annual Reports since 1976. The country underlined is the one which submitted the report.

Species	Exporter	Importer	Origin	Commodity
1985				
C. mydas	Philippines	Italy		1 shell
E. imbricata	Philippines	USA		2 live
1984				
Cheloniidae	Australia	UK	Philippines	2 shells
	France	USA	Philippines	1 item
	Philippines	USA		7 items
C. mydas	Philippines	Italy		1 body
	Philippines	USA		17 items
E. imbricata	Philippines	Denmark		2 bodies
	Philippines	USA		11 bodies
1983				
Cheloniidae sp	Philippines	USA		5 items
C. mydas	Philippines	Japan		2 bodies
	Philippines	USA		23 items
	Saudi Arabia	USA	Philippines	1 carving
E. imbricata	Hong Kong	USA	Philippines	2 items
	Philippines	Japan		1 body
	Philippines	USA		786 items
1982				
Cheloniidae	Philippines	USA		29 items
C. mydas	Philippines	USA		47 items
E. imbricata	Philippines	USA		36 items
1981				
Cheloniidae	Philippines	USA		11 items
C. mydas	Italy	Philippines	Ecuador	8 pairs of shoes
	Philippines	Italy		300 kg scales
	Philippines	USA		73 items
E. imbricata	Philippines	USA		154 items
1980				
Cheloniidae	Philippines	USA		43 items
C. mydas	Philippines	USA		39 items
E. imbricata	Philippines	USA		75 items
	Philippines	USA		12 lbs shells (C)
1979				
C. mydas	Philippines	Australia		10 bodies
1978				
Cheloniidae	Philippines	Canada		3 shells
1977				
E. imbricata	Philippines	Switzerland		1 body

are kept for about eight months before being released on nearby islands. The project was started in 1982, and between then and the time of writing (1984?), 636 hatchlings were reared. Reported survival rate was only 36% (Rodriguez, 1984).

A rearing project involving E. imbricata was being run in the Cuyo Islands by the Coral Research Project of the Bureau of Fisheries and Aquatic Resources. Hatchlings were collected and given to volunteer local families to rear in fish tubs for up to a year, after which they were released. Of the 83 hatchlings reared in 1983, only 18 reached the yearling stage (Rodriguez, 1984).

LEGISLATION

Successively stricter controls on turtle protection in the Philippines have been promulgated, culminating in a complete ban on all exploitation in 1982. The main regulations are listed below.

Regulation for the conservation of turtles, turtle eggs, and turtle shells in the Philippines, 9 June 1967.

The taking of sea turtles, their eggs and shells, is prohibited for a period of five years:

C. mydas
E. imbricata
L. olivacea
D. coriacea

Regulations governing the collecting, gathering and/or disposing of marine turtles, turtle eggs, and their products in the Philippines, 10 July 1974.

Prohibits the taking, sale, transport, export of turtles and their eggs.
Permits may be issued for educational or scientific purposes.
Collecting prohibited 1 January-31 May inclusive and is only allowed in areas designated by the Director. At least 100 eggs must be retained in every nest. Collecting of any turtle less than 30 cm is prohibited.

Regulations for the conservation of marine turtles in the Philippines, 15 November 1979.

Except in regions 9 and 12, no new permits are to be issued for collecting, gathering, utilising, possessing, transporting, removing, and/or disposing of marine turtles, turtle eggs and turtle by-products.
In regions 9 and 12 permits may be issued for the above activities, provided that the quantity is specified on the permit and that such a harvest (except turtle eggs) shall be sold only to government authorised agencies.
Export of marine turtles, turtle eggs and turtle by-products is prohibited.

MNR Administrative Order No. 33, Series of 1982.

Marine turtle eggs may be collected in the Province of Tawi-Tawi only under permit, under the following conditions:
30% of all eggs laid shall be reserved for preservation purposes. Such nests shall not be disturbed in any way.
10% of all nests may be gathered and sold, the proceeds being given to the Tawi-Tawi Marine Turtle Conservation Foundation.

The remaining 60% may be gathered by permittees on payment of a fee to the Municipality.
Permits are valid only from April to December.

Memorandum Order No. 6, Series of 1982, 29 April 1982.
In line with Executive Order No. 542, 1979, a total ban on turtle exploitation is declared. No further permits will be issued to collect, possess, transport, remove, export and/or dispose of marine turtles, eggs and by-products. [This Order was evidently superseded by No. 33 with regard to the collection of eggs.]

Administrative Order No. 8, 8 June 1986. (Establishment of Marine Turtle Sanctuaries).
Establishment of the following islands/islets as Marine Turtle Sanctuaries:-

(1) Province of Tawi-Tawi	a. Bancauan Island
	b. Daguan Island
(2) Province of Palawan	a. Halog Island
	b. Tanobon Island.
	c. Panata Cay
	d. Kota Island
(3) Province of Antique	a. Panagatan Island

Within these sanctuaries it is prohibited to:-
(a) kill or take marine turtles or gather turtle eggs,
(b) destroy or disturb marine turtle habitats, either on land, or in the sea within 250 m of the lowest tidal line.

PITCAIRN

POPULATION

There are no records of nesting by C. mydas or E. imbricata (or any other sea turtles) on Pitcairn, Henderson, Ducie or Oeno Islands; however, no specific survey work has been carried out (G.D. Harraway in litt., 24 November 1986). Pritchard (1982a) stated, with reference to Pitcairn and Henderson, that there is no evidence that the occurrence of turtles around the islands is anything more than sporadic. During 1983 (the only year for which the Office of the Governor has records) there were eight sightings of C. mydas and six of E. imbricata (G.D. Harraway in litt., 24 November 1986).

EXPLOITATION

Up to five turtles have been taken by the Pitcairners during the past 15 years; at least one was eaten and the remainder taken for their carapaces. There is no regular harvesting of turtles, and no trade (local or international) in sea turtle products (G.D. Harraway in litt., 24 November 1986).

International trade Pitcairn and Henderson Island are included in the UK ratification of CITES. CITES Annual Reports have indicated no trade in any sea turtle products from Pitcairn.

LEGISLATION

Local Government Regulations Part III. Plant and Animal Quarantine Amendment 1976.

Requires the issue of a permit for the import or export of all species listed on the CITES Appendices.

Local Government Regulations Part IV Amendment No. 2, 1982.

No person may harass, hunt, kill or capture any sea turtle (Cheloniidae and D. coriacea). Exceptions may be granted under permit for scientific purpose or for traditional subsistence use.

POPULATION: Chelonia mydas

Nesting sites Gonzalez (1984) identified nesting sites at Yellow Beach on Vieques Island and Playa Brava and Playa Resaca on Culebra Island. Carr et al. (1982) reported nesting on Mona Island and noted the occurrence of suitable nesting beaches along the northern and western coasts of Puerto Rico.

Nesting numbers Gonzalez (1984) estimated the nesting population of C. mydas in 1977 and 1981 to be only four. Bacon (1981) noted occasional nesting on mainland Puerto Rico and Carr et al. (1982) reported "some" nesting on Mona Island and infrequent nesting on Culebra and Vieques. Kontos (1988) found no nests of C. mydas on Mona between July and November 1987, but confirmed that some nesting had occurred in previous years. Vivaldi (in litt., 5 September 1986) described the nesting abundance of C. mydas as "high", but it is not clear what this was based on.

Trends in nesting numbers Vivaldi (in litt., 5 September 1986) considered the nesting population of Green Turtles to be decreasing. Carr et al. (1982) noted that Green Turtles nested on Culebra and Vieques in smaller numbers than in former years.

Nesting season Nesting reported by Gonzalez (1984) occurred mainly between May and September but in one case it was reported to have occurred between May and February.

Foraging sites Gonzalez (1984) identified foraging sites at the Bahia Playa Blanca on Vieques Island and on the reefs at Culebra Island. Juveniles were reported to be abundant, particularly at Culebra, and were also found at Mona (Carr et al., 1982).

POPULATION: Eretmochelys imbricata

Nesting sites Nesting sites were identified at Green Beach on Vieques; Playa Sardinera on Mona; Playa Resaca, Playa Brava, Playa Larga and Cayo Norte on Culebra; several beaches on Culebrita; and at Playa Punta Arena, Tablonal de Aguada, Pinones and possibly Playa Jobos de Isabela on the mainland. Bacon (1981) noted nesting on Monita. On Mona, the primary beaches are at the west of the island, between Sardinera and Carite. Further, more scattered nesting occurs along the south coast (Kontos, 1988).

Nesting numbers Bacon (1981) reported occasional nesting on mainland Puerto Rico and Carr et al. (1982) noted numerous Hawksbills nesting on Mona Island and occasional nesting on Vieques and Culebra. Olson (1985) reported finding 151 Hawksbill nests on Mona Island during a study in 1984. This total was later questioned by Kontos (1988) who adjusted it down to less than 100 on the basis that Olson's figure was derived from nest pits rather than actual nests. Surveys from 1985 to 1987 gave totals of 85, 68 and 71 nests on Mona for the three years respectively (Kontos, 1988).

Trends in nesting numbers Vivaldi (in litt., 5 September 1986) considered the Hawksbill nesting population to be decreasing. Gonzalez (1984) reported the occurrence of 105 Hawksbill nests at Uvero Carabinero in November 1973. Kontos (1988) examined the trends in nesting numbers on Mona Island using, as a baseline, a survey carried out in 1974 which estimated a total of 171 nests in that year. By 1987, nesting numbers had fallen to 71, some 42% of the 1974 figure.

PUERTO RICO

Nesting season Kontos (1988) reported that peak nesting on Mona Island was from August to November.

Foraging sites Gonzalez (1984) identified foraging sites on the reefs at Culebra Island and also at Monita Island. Carr et al. (1982) noted that Hawksbills of all ages and sizes, except for those of the "lost year" group, inhabited the diverse reef area of Puerto Rico and its adjacent islands.

THREATS

On Mona Island, Kontos (1988) reported that all of the 35 nests laid on unprotected beaches in 1987 were destroyed by feral pig predation. The remaining 26 nests laid on 3 km of beach which had been protected by fencing suffered no predation.

EXPLOITATION

Commodity Hawksbills were taken in substantial numbers on Mona Island for their meat, scutes and eggs (Olson, 1985). Turtle eggs were taken whenever possible and Hawksbill shells were popular as wall hangings (Carr et al., 1982).

Hunting intensity In 1987, Kontos (1988) found the remains of eight turtles which had been killed by humans, including two C. mydas and four E. imbricata.

Hunting methods Carr et al. (1982) reported the spearing of Hawksbills to be a popular sport among divers and also noted that "surreptitious" netting of turtles was common.

Historical trends All species of sea turtles have been heavily exploited through the region (Carr et al., 1982). FAO Fishery Statistics record annual sea turtle catches of 100 metric tonnes in the years 1966-1968 and also in 1971. Olson (1985) considered that the US Endangered Species Act had reduced the extent of human predation on the sea turtles of Mona Island but had by no means eliminated it.

International trade Japanese imports of bekko and other tortoiseshell from Puerto Rico are given in Table 168. CITES annual reports for the period 1977-1985 recorded the illegal shipments from Puerto Rico, seized on entry into the USA, of sea turtle oil, bodies, shells, meat and carvings. Puerto Rico is covered by the USA's ratification of CITES (14 January 1974).

Table 168. Imports of bekko (kg) from Puerto Rico, 1963-1979, reported in Japanese Customs Statistics. No other imports of bekko were reported from 1950 to 1986.

	'63	'64	'65	'66	'67	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79
Bekko	1612	226	227	-	196	77	585	974	700	498	341	45	165	262	264		18
Other	0	0	0	0	0	0	27		32	0	0	0	0	0	0	0	0

LEGISLATION

Reglamento DRN Especies Vulnerables y en Peligro de Extinction 08/85. (28 February 1985)

It is illegal to catch, kill, possess, sell, transport or export any endangered species. Local, interstate and international commerce is prohibited. Exemptions may be granted to DRN personnel for specific purpose, for specimens born in captivity, and for scientific or conservation purposes. E. imbricata, C. mydas, D. coriacea, L. kempii are designated as being both locally and federally endangered. C. caretta is designated as vulnerable. Several critical habitats have been designated for E. imbricata.

QATAR

POPULATION: Chelonia mydas, Eretmochelys imbricata

Green Turtles formerly nested on the mainland at Ras Laffan and Umm Said, but no longer. A few Hawksbills nest on Sharaawh and Dayinah islands (hatchling reported in early July, suggesting nesting in early May), and nesting appears to have occurred in the past on Aliya and Safaliyah islands, but not at present (Ross and Barwani, 1982). Green Turtles feed on seagrass pastures off the east coast.

THREATS

Development is a threat to turtles; a port project at Ras abu Khamis has led to degradation of coral reefs and decline in local Hawksbill numbers (Ross and Barwani, 1982).

EXPLOITATION

Commodity Information on exploitation, collected by Ross and Barwani, is ambiguous: one informant stated that Green Turtles were not commonly consumed; another said they were often seen in fish markets. Hawksbill meat and eggs are said to be eaten whenever found (Ross and Barwani, 1982).

Hunting intensity It has been suggested that the annual catch of Green Turtles is "no more than a few hundred" (source cited in Ross and Barwani, 1982).

Hunting methods Turtles are caught in trawl nets off Qatar; reportedly most of these are said to be returned alive to the water. Some eggs are also collected (Ross and Barwani, 1982).

International trade Qatar is not a party to CITES, and CITES Annual Reports record no trade in sea turtle products emanating from Qatar.

LEGISLATION

There are no protective regulations for sea turtles in Qatar (Ross and Barwani, 1982).

REUNION

Réunion was an important turtle nesting site, largely or entirely by C. mydas, at the time of human colonisation in the 17th-18th centuries. Large-scale nesting ended in the 19th century; this local extirpation is attributed initially to over-exploitation, and finally to coastal development and tourism (Bertrand et al., 1986). There appears to have been no confirmed nesting in more recent years although there are unconfirmed reports from the 1950s-1960s (Bertrand et al., 1986; Bonnet, 1986). Three sets of tracks, apparently made by the same individual, were recorded on 28 June 1986 at Etang Salé on the south-west coast, but nesting was not completed (Bertrand et al., 1986). Both C. mydas and E. imbricata, particularly juveniles, occur in Réunion waters, notably along reefs but rarely in lagoons.

EXPLOITATION

Commodity Only turtle material originating in the ranch (C. mydas) may legally be sold in Réunion. Products sold include meat and liver, fresh, smoked or tinned; jewellery and marquetry fashioned from shell; polished carapaces; and more recently, oil (Bonnet in litt., 22 April 1987). There is also some illegal trade in Hawksbill shell jewellery, and lampshades made from imported C. mydas shell were also seen on sale in 1987.

Historical trends In the early days of French colonisation of Réunion, turtles were exterminated largely by exploitation. Some were used to supply visiting ships (Lougnon, 1958).

Domestic trade There is a growing industry on the island based on the products of the turtle ranch. Some 25 local artisans are employed in making jewellery and other shell products. Many restaurants offer turtle meat dishes; one smokehouse is involved in making smoked turtle, and a canning factory also uses the meat and calipee. A marking system to identify all turtle products derived from the ranch will be put into operation in the event of receiving CITES approval of the ranch (Bonnet in litt., 22 April 1987). Most turtle products seen on sale in January 1987 bore no indication of their origin.

International trade Réunion is an Overseas Department of France, and it is therefore covered by France's acceptance of CITES and included in the European Economic Community (EEC). France held reservations under CITES on C. mydas and E. imbricata but when EEC Regulation 3626/82 came into force on 1 January 1984, all the reservations became void. France officially withdrew its reservations on 10 December 1984. All trade with Metropolitan France is not considered to be international trade, and is therefore not covered by CITES controls. Under the terms of EEC Regulation 3626/82, trade between countries in the EEC is also considered to be equivalent to internal trade. Trade in Appendix I species is permitted provided that the animals have been taken from the wild within the EEC with the approval of the competent authorities, and a certificate has been issued to that effect. This exemption is considered to apply to the products of the ranch on Réunion, but the Netherlands, Denmark and F.R. Germany have given notice that they will refuse to allow the import of turtle products from Réunion. Since 1 January 1984, no export permits have been issued for the export of turtle products outside the EEC, but several certificates have been issued to allow their trade within the EEC. Most of the products which leave Réunion have been destined for France (Salvadori, pers. comm.).

REUNION AND ILES EPARSES

One important technical point is that the Iles Eparses appear not to be in the EEC, and consequently the import of hatchlings from Europa and Tromelin to Réunion is in contravention of EEC Regulation 3626/82; certificates to allow trade in their products should not therefore be issued. An alternative interpretation, according to Bonnet (in litt., 22 April 1987), is that the French Government has considered the Iles Eparses to be French territory directly administered by the national government itself, in which case EEC certificates would not be necessary for the transport of hatchlings to Réunion. However, both the EEC Commission and French Customs authorities have stated that the Iles Eparses are not within their jurisdiction, in which case strict interpretation of the law indicates that such transport is indeed in contravention of Regulation 3626/82.

There is evidence of a small amount of illegal import to Réunion of turtle products from elsewhere, as material from Madagascar and South East Asia are on sale in the island.

LEGISLATION

Arrêté No. 1985/DAE/CE (4 July 1983) relatif à la réglementation de la production et de la commercialisation des tortues marines sur la territoire du Département de la Réunion.

1. The destruction, removal, capture, utilisation. manufacture, transport, purchase, sale or offering for sale of C. mydas and E. imbricata originating in the wild, or their nests, eggs, or other products is prohibited.
2. These provisions shall not apply to C. mydas raised on a ranch under due authority.
3. All trade, donation, transport, introduction, import and export of C. mydas and their products, except those covered by article 2, and of all E. imbricata is prohibited.

RANCHING

Name of operation Société Bourbonnais d'Aquaculture, Pointe des Châteaux, St Leu, 97436 Réunion.

The ranch is situated on a narrow strip of land between the main road and the sea, near St Leu. It was originally set up in 1977 under the name of CORAIL (Compagnie Réunionnaise d'Aquaculture et d'Industries Littorales), but this ran into financial difficulties and the ranch was taken over and reconstituted as SBA in 1985. Following the rejection of the proposal submitted to the 6th meeting of the Conference of the Parties to CITES in 1987, the financial future of the ranch was again thrown into doubt. An apparent attempt to reduce the stock by clandestine slaughter was prevented by the intervention of the authorities in March 1988 (Courbis, 1988).

Species and numbers The commercial operation depends principally on C. mydas, although a single adult E. imbricata is kept for display purposes. Recent economic diversification has seen the experimental rearing of Tilapia spp. The stock of C. mydas in the farm is given in Table 169. The stock built up to a peak in 1981, when an administrative decision was taken to reduce production, and the majority of the stock was slaughtered. Since 1984, the stock has been progressively increased.

Table 169. Hatchling intake, mortality (including selective culling), production and annual stock levels of _C. mydas_ at SBA (formerly CORAIL) ranch (Anon., 1987a).

Year	Hatchling intake	Mortality	Slaughter (production)	Final stock
1978-79	21 882	8 940	0	12 942
1980	10 035	3 877	0	19 100
1981	12 583	9 642	2 697	19 344
1982	10 705	2 358	20 751	6 940
1983	0	27	2 345	4 568
1984	2 318	156	1 939	4 791
1985	5 343	2 129	1 177	6 828
1986	8 042	2 760	2 011	10 099
Total	70 908	29 889	30 920	10 099

Production and trade The principal products of the farm are meat, calipee, carapaces and shell. There have been exploratory moves to interest French cosmetic companies in the oil. The leather is not used and is currently destroyed, although markets may be developed in future. The meat is sold mostly to restaurants in Réunion; some is tinned and smoked on the island, and some is exported to France. The calipee is mostly exported to France for soup manufacture. Shell is sold to artisans on the island who make jewellery and use it for marquetry. It is much thicker than the shell of wild _C. mydas_, and is comparable in quality to the shell of _E. imbricata_. Techniques have been developed to laminate it so that it can be used to manufacture spectacle frames. It is hoped to expand this market, and substitute ranched _C. mydas_ shell for that of wild-caught _E. imbricata_; French companies are interested in this product and Japanese craftsmen have indicated that it may be an acceptable substitute for bekko (G. Lebrun _in litt._, 20 February 1987). Whole carapaces are prepared and polished at the ranch for sale to visitors. Smaller animals which die or are selectively culled are used for this purpose as are a few large carapaces.

Source of stock All of the stock derives from hatchlings collected on the islands of Europa and Tromelin (q.v.). The numbers received on the farm are shown in Table 169. There is a major discrepancy between the numbers received on the farm in 1982 (10 705) and the numbers reported to have been removed from the islands (5064 from Tromelin: Anon., 1987a). According to Bonnet (_in litt._, 22 April 1987), this is because the document cited (Anon., 1987a) inadvertently omitted the 1982 offtake from Europa, presumably amounting to 5641 hatchlings. There are also discrepancies between the numbers removed in 1985 and 1986, the ranch reporting receipts of 5343 and 8042 (i.e. 343 and 42 in excess of the removals reported) in the two years respectively; this may be attributable to errors in transcription (Bonnet _in litt._, 22 April 1987).

There is no attempt at breeding turtles at the ranch, and none of the basins is suitable for this purpose.

Husbandry The ranch is situated close to the shore, and has a continuous supply of pumped seawater, which passes once through each tank and then

Table 170. Commercial production of the ranch from 1981 to 1986. The 1986 figures are not finalised (Anon., 1984b and 1987a; Bonnet <u>in litt.</u>, 22 April 1987).

	1981	1982	1983	1984	1985	1986
Slaughter						
Turtles	2697	29751	2345	1939	1177	2011
Live wt. (kg)	55716	202933	58590	44716	36200	32388
Direct Sales						
Meat (FF1000)	830	1136	1121	982	861	514
" (kg)	19500	29260	27700	28000	21500	9300
Liver (FF1000)						17
" (kg)		5000	2000			
Calipee (FF1000)	40	287	531	105	161	47
" (kg)	600	3100	5629	1200	1500	500
Raw shell (FF1000)	11	15	122	37	50	84
" (kg)	9	12	172	26	36	60
Carapaces (FF1000)	245	1251	6229	978	1054	1100
" (Nos)		997	11887	985	1362	
Sales of manufactured products (FF1000)	118	37	64	185	449	675
Income from visitors (FF1000)	–	–	–	–	170	350
Total Income (FF1000)	1243	2726	8067	2286	2746	2788

flows to waste. Hatchlings are kept in 24 small tanks in a covered hatchery. This was formerly supplied with heated seawater (using a heat-exchanger) but the heating has since been abandoned as it was too expensive. After about a year, the young turtles are moved to a series of large outdoor basins, increasing in size, where they are grown for a further 2-4 years. For meat production, it is thought to be best to slaughter the animals at a weight of 20-30 kg, which they reach at an age of 3-4 years (Le Gall, 1985). Thicker shell is produced if the animals are grown on until they are about five years old, and this strategy is gradually being adopted, owing to the high value of the shell (Lebrun, pers. comm.).

The turtles are fed on an artificial pelleted diet, imported from France, which has a protein content of 47% (Le Gall, 1985). The stocking rate can be as high as 150 kg m^{-3}, allowing a total production of 150 t live weight a year (Le Gall, 1985; Anon., 1987a).

Mortalities occur chiefly in the first year of life. A significant proportion of young turtles grow slowly and show a lack of vigour. These are selectively culled. The combined mortality and culling is shown on

Table 169, and has amounted to a cumulative loss of 42% of the total hatchling intake since the farm started. The mortality in subsequent years has been significantly lower (Bonnet, 1986; Anon., 1987a).

When the turtles are selected for slaughter, they are kept in separate tanks for 5-6 days without food to allow emptying of the alimentary tract. They are then taken to a nearby slaughterhouse, shot in the skull with a humane killer, exsanguinated and butchered in accordance with French veterinary health regulations.

Turtles reared at the farm have suffered from severe dermal necroses, affecting the skin of the flippers and neck, in some cases resulting in the amputation of the end of the hind flippers. Experiments have shown that these necroses have been at least partially due to a nutritional imbalance, resulting from a deficiency in certain fatty acids. Supplementing the diet has produced improvements; the lesions on the hind flippers, formerly the worst affected area, have mostly disappeared, although they are still present on the fore flippers and neck. Further nutritional investigations are in progress (Bonnet, 1986).

Finances The farm income from various sources is shown in Table 170. Current prices are FF55 a kg for meat, FF150 a kg for calipee, FF1500 for polished carapaces, FF100 a kg for oil, FF1500 a kg for medium quality shell, and FF3500 a kg for top quality shell. An economic analysis provided in 1987 showed that, on turtles alone, the farm could break even with an annual production of 2500 turtles, giving 75 t live weight a year. This would require the removal of 4300 hatchlings a year, and would give a turnover of FF3.5 million. At full capacity, the farm could produce 5000 turtles a year, giving 150 t, and a profit of FF865 000 on a turnover of FF7.26 million. Food accounted for about half of the running costs. Although there is said to be a large local market for meat, much higher prices can be obtained for exports to Metropolitan France (Anon., 1987a). Meat sold locally between 1981 and 1984 averaged FF38 a kg, while that exported to France fetched FF61 a kg (Le Gall, 1985).

Status A proposal to transfer the Europa and Tromelin populations of C. mydas was prepared by France for the 4th Meeting of the Conference of the Parties to CITES in April 1983. After lengthy discussion in the committee stage the proposal was withdrawn. A revised proposal was submitted to the 5th Meeting held in June 1985, but was rejected, largely on the grounds that the procedures for marking the products of the operation were inadequate. Revised marking procedures were submitted to the CITES Technical Committee Meeting held in June 1986 and were accepted. A revised ranching proposal was submitted to the 6th Meeting of the Conference of the Parties to CITES, but was rejected.

EUROPA

POPULATION: Chelonia mydas

Nesting sites Nesting occurs along a portion of the lagoon complex situated in the north-east, and extends along parts of the north, west, and south coasts (Le Gall et al., 1985). Hughes (1974, Table 11) estimated the length of nesting beach at around 6.7 km. Survey work has been concentrated on the 500-m Station Beach (adjacent to the Meteorological Station).

Nesting numbers Hughes (1970) calculated the minimum number of nesting females on Europa as 4274, based on fieldwork between 5 November and 20 December 1970 (estimated as nightly emergence total, multiplied by re-nesting interval by percent nesting success). Around 50 females emerged nightly on Station Beach during this period, with a nightly island total of around 710 (Hughes, 1974, Table 11). Around 43% of emergences resulted in successful nesting (Hughes, 1970). Hughes (1974, Table 15) later estimated an annual nesting population of 4000-9000 females. Servan (1976) very rarely recorded more than 10 females nightly on Station Beach between February 1973 and February 1974, and estimated the annual female population as 1300. Servan (1976) suggested that the difference between his estimate and that of Hughes (1970) was due to annual fluctuation in nesting numbers; it seems likely that some may be due to different methods of data collection and analysis. Vergonzanne et al. (1976) recorded a mean of 20 females nightly between 10 August and 2 October 1973, involving around 1000 turtles, and more than 3000 emergences in January 1974; they estimate the total female population between February 1973 and February 1974 was around 2000. It is not clear how many nest beaches were covered. Bonnet (1986) reports between 200-550 emergences nightly during January, the period of most concentrated nesting.

Le Gall et al. (1985 and 1986) have recently provided nesting and hatchling data for 1981-1985, based on consistent field and analytical methods. Salient figures from this work are given in Table 171.

Table 171. Nesting and productivity data for Europa (data from Le Gall et al., 1985 and 1986; including their re-analysis of data from Servan, 1976). The 1970 figure is from Hughes (1970), the 1973-74 (S) figure is from Servan (1976). Note that the 1985 work by Le Gall et al. gives figures of 698 and 8149 for Station Beach and Total nests in 1981-82, the data cited are from Le Gall et al. (1986). The peak quarter comprises November-January, during which 50-70% of annual nesting occurs. Female numbers are derived by dividing the total number of nests observed by the mean number of nests in a marked sample of females. The annual total is extrapolated from the peak quarter figure. Monitoring has been concentrated on Station Beach. The island totals are extrapolated from Station Beach data; the factor employed in this calculation is clearly critical to the size of the final estimate of female numbers.

Year	Station Beach nests	Total nests	Station Beach females	Total (peak quarter)	Females (per year)	Hatchlings (peak quarter)	Hatchlings (per year)
1970				4 274			
1973-74 (S)					1 300		
1973-74	475	5 548	177	2 070	4 140	693 288	1 386 000
1978-79	1 283	14 967	478	5 584	-	1 913 000	-
1980-81	730	8 518	272	3 178	-	793 281	-
1981-82	765	8 919	285	3 327	-	758 918	-
1982-83	1 349	15 729	462	5 386	-	1 528 000	-
1983-84	2 115	26 136	877	10 844	15 491	2 128 000	-
1984-85	644	8 471	237	3 125	7 812	890 215	1 271 000

Le Gall et al. (1986) note the marked fluctuation in nesting numbers on Europa, a phenomenon that has been reported at many other sites, notably at Tortuguero (Costa Rica) and on the Great Barrier Reef (Australia). These authors suggest an overall peak season nesting population of 2000-11 000 females on Europa. On present information, Europa is one of the most important single C. mydas nest sites in the Indian Ocean, and one of the larger nesting populations in the world.

Trends in nesting numbers The available data do not indicate any clear trends in nesting numbers, or hatchling productivity, from the 1973-74 season onward. It also seems likely that no sustained decline has occurred during the 20th century: Petit (1930: p. 103) reported that around the first decade of the present century the staff of a European commercial operation could only capture a twentieth of the number of females which came to nest each night, but the size of the harvest is not known.

Nesting season According to Bonnet (1986) nesting is essentially limited to November-April, in the austral summer, most nesting taking place during November-January (Le Gall et al., 1986).

Foraging sites A substantial proportion, possibly the major part, of the population nesting at Europa appears to be migratory, using foraging grounds around Madagascar and the Mascarenes. The western seaboard of Madagascar in particular appears to be a major turtle feeding ground. Bonnet (in litt., 22 April 1987) reports that waters around Europa support a more or less resident population of juvenile and sub-adult Green Turtles, feeding on algae, seagrass and possibly zoobenthos. Hughes (1970), although he saw numerous non-adult turtles, particularly in the shallow lagoon, stressed the paucity of food resources and suggested that turtles in the area were subsisting on fat reserves (this would imply that they were non-residents).

Migration Fifteen of 4843 females tagged on Europa have been recaptured away from Europa: one near Maputo (Mozambique), one from the Mauritius area, and 13 from Madagascar, mostly from the south-west coast (a prime feeding area, and the hunting ground of the Vezo and Sakalava peoples). One female tagged on Tromelin in 1973 was subsequently recovered on a beach on Europa in 1982 (Le Gall and Hughes, 1987).

POPULATION: Eretmochelys imbricata

Hughes (1970) reported seeing many Hawksbills, mainly juveniles; according to Hughes (1982b) the species is seen only occasionally on Europa. Bonnet (1986) states that it is seen quite frequently in waters around Europa. A footnote in Vaillant and Grandidier (1910: p. 78) indicated that the large numbers of turtles nesting on Europa include "caret" or E. imbricata in particular; presumably they were misinformed as to the species' identity, or perhaps Hawksbill nesting has greatly declined.

EXPLOITATION

Commodity Turtles are not hunted on Europa, and the only current exploitation is the removal of hatchling C. mydas for the ranch on Réunion. Formerly, Green Turtles were taken for food, and there is a report of a fishery for Hawksbills (Vaillant and Grandidier, 1910), although this must be considered doubtful (see below).

Hunting intensity The number of hatchlings removed from Europa for the ranch in Réunion were 21 882 in 1978-79, 4033 in 1979-80, 6984 in 1980-81 and 2396 in 1985-86 (Anon., 1987a). There is a major discrepancy in the figures which indicates that a further 5000 hatchlings may have been collected in 1981-82 (see above).

Hunting methods The methods by which hatchlings are collected are the same as those used at Tromelin (q.v.). All transport to and from Europa is on military aircraft, and consequently the transfer of hatchlings to Réunion may be more delayed than on Tromelin.

Historical trends The turtles of Europa were formerly exploited by a variety of fishing concerns, including the members of short-lived settlements established in 1860, 1903 and later, until the end of human habitation around 1923 (Paulian, 1950). Vaillant and Grandidier (1910) reported that the Antifiherenana from Madagascar used to visit Europa to catch "carets" (usually E. imbricata, but probably mistakenly used here for C. mydas), which they took back to their villages "towing them behind their canoes". A European company stationed staff on the island to catch turtles at an unknown date (presumably after 1903) but could only manage to kill and process a twentieth of the number of females which nested each night. Other fishermen were thought to be active on the island in 1916. Around 1922, a Creole from Tulear, Madagascar, used to visit Europa to catch turtles, which he returned live to sell in Tulear (Petit, 1930). Paulian (1950) reported that large piles of turtle bones existed on the north coast of Europa, all old, and took this as evidence of exploitation in the early decades of the century, not contemporary. The magnitude of past exploitation, and the extent to which it was "organised" (Frazier, 1980a), is impossible to assess.

LEGISLATION

Arrêté No. 1989/DG/01 (4 July 1983) relatif à la réglementation de la production et de la commercialisation des tortues marines sur le territoire des Iles Eparses.

1. The destruction, removal, capture, utilisation. manufacture, transport, purchase, sale or offering for sale of C. mydas and E. imbricata originating in the wild, or their nests, eggs, or other products is prohibited.
2. These provisions shall not apply to C. mydas raised on a ranch under due authority.
3. All trade, donation, transport, introduction, import and export of C. mydas and their products, except those covered by article 2, and of all E. imbricata is prohibited.

   The Iles Eparses are classified as Strict Nature Reserves. All damage to flora and fauna is prohibited, and all access is forbidden without written permission from the Prefêt of Réunion.

THREATS

No clear threats around the island are evident. Before 1923, when the French administration made Europa a protected area, considerable numbers of nesting females were taken on the island. Large numbers of turtles are taken on their foraging grounds off south-west Madagascar (see MADACASCAR account); some of these turtles are known to be from Europa, and it is suspected that Europa turtles provide the greater part of the Madagascar

catch. This level of harvest may well be a threat. Hughes (1971b) asserted that a great number of nests on Europa are destroyed by later nesters, and inferred from this density-dependent mortality that the population could withstand increased hunting pressure. In fact, the extent of mutual nest destruction has been little investigated: Hughes (1970) stated that the number so destroyed was "not inconsiderable", but was not able to demonstrate the proportion of nests involved; Servan (1976) actually recorded only three such instances, and noted that some other nests were destroyed by sea water.

TROMELIN

POPULATION: Chelonia mydas

Nesting sites Beaches used by nesting turtles extend for some 1.6 km around the north-western half of the island; most nesting takes place on the north-east and south-west beaches, and very little at the north-western tip of the island (Vergonzanne et al., 1976). The nesting area is small enough to allow comprehensive monitoring of nesting activity.

Nesting numbers Hughes (1974, Table 15) estimated an annual nesting population at Tromelin of 200-400 females over the 1970-1971 season (based on field work between 15 October and 6 November). Batori (1974, unpublished; also cited by Vergonzanne et al., 1976) recorded about 11 females nightly during the winter months (July-September) of 1973 and three nightly in June-July 1974; in summer 1973-1974 (November-January) Batori recorded around 54-148 females nightly. Hughes later (1976) estimated the annual total at around 2000. Hughes (1982b) cited other estimates from Lebeau et al. (not seen) of 1000 females in 1977, and around 4400 in 1978. Between 86 and 116 females nightly were recorded by Bonnet (unpublished) in November-December 1980. More recently, Le Gall et al. (1985 and 1986), have provided nesting and hatchling estimates for the years 1981-1984, based on consistent field and analytical methods. Salient figures from this work are given in Table 172.

Le Gall et al. (1986) report a close correspondence between nesting estimates obtained by the more traditional methods, cited above, and a multiple capture-recapture method. The results were particularly close in the case of Tromelin, and a little less so in the case of Europa (where only one beach can be monitored thoroughly). These authors give an overall peak quarter estimate for Tromelin of 730-1350 females (95% confidence limits).

Trends in nesting numbers The available data show no clear trend in numbers. The number of tracks recorded appeared to be declining until 1985-86, but the following season, 1986-87, was the highest recorded.

Nesting season Some nesting occurs through much of the year, but mostly between November and May, with 50-70% of all activity taking place during November-January (Bonnet et al., 1985; Le Gall et al., 1985).

Foraging sites A substantial proportion of the population nesting at Tromelin appears to be migratory, using foraging grounds around Madagascar and the Mascarenes. Although adult turtles have been observed feeding on algae around Tromelin, food resources appear inadequate to support large numbers throughout the year (Bonnet, 1985 and in litt., 22 April 1987).

Table 172. Nesting and productivity data for Tromelin. Data from Le Gall et al. (1985 and 1986), including 1973-74 data from Batori (1974, not seen); 1985-87 data from Bonnet (unpublished) and Anon. (1987a). The peak quarter comprises November-January, during which 50-70% of the annual nesting occurs. Female numbers are derived by dividing the total number of nests observed by the mean number of nests in a sample of marked females. The annual total is extrapolated from the peak quarter figure. The figures for 1984-87 are from Bonnet (pers. comm.) and Anon. (1987a). * December-January only.

Year	Tracks (3 months)	Nests (3 months)	Females (3 months)	Females (per year)	Hatchings (3 months)	Hatchings (per year)
1973-74	5 823	3 260	1 112	1 660	309 726	461 491
1981-82	5 102	2 857	1 236	-	297 306	-
1982-83	5 171	2 895	937	-	228 197	-
1983-84	5 703	3 193	940	1 958	152 606	250 173
1984-85	3 261	1 822			170 000	
1985-86	1 866	1 042			100 000	
1986-87	5 945 *					

Migration Twelve of 3766 females tagged at Tromelin have been recaptured in distant waters; four from north and east Madagascar, six from Mauritius, one from the St Brandon group and one from Europa (Le Gall and Hughes, 1987). This last female was tagged on Tromelin in December 1973 and next seen on two successive nights in December 1982 on a beach on Europa (it is not stated whether nesting was successfully completed). This is an observation of great significance, and appears to be the only documented long-distance shift in nest site shown by any sea turtle.

POPULATION: Eretmochelys imbricata

According to Hughes (1982b) some E. imbricata were seen occasionally at Tromelin; however, the species was not recorded in Tromelin waters between 1980 and 1987 despite much fieldwork (Bonnet in litt., 22 April 1987).

EXPLOITATION

Commodity Turtles are not hunted on Tromelin, and the only exploitation is the removal of hatchling C. mydas for the ranch on Réunion.

Hunting intensity The number of hatchlings removed from Tromelin for the ranch in Réunion were 0 in 1978-79, 6002 in 1979-80, 5599 in 1980-81, 5064 in 1981-82, 0 in 1982-83, 5000 in 1983-84, 5000 in 1984-85 and 5604 in 1985-86. Half of the turtles taken in 1983-84 were used for headstarting experiments by IFREMER (Anon., 1987a).

Hunting methods Regulations in force stipulate that hatchlings may only be collected during daylight hours. The hatchlings are collected by staff of the meterological station, who may not leave the station until after daybreak and must return before 30 minutes after sunset. Nests may not be dug out, and hatchlings may only be collected once they have emerged onto

the surface of the sand. The hatchlings are bathed in gentian violet and then kept in tanks, regularly replenished with fresh seawater, awaiting transport by plane to Réunion. It used to be the practice to release half of these hatchlings into the sea at night, the hatchlings being selected on the basis of their size and vigour. However this procedure was questioned on the grounds that it might genetically alter the wild population, and from 1985 onwards, entire broods were retained, any hatchlings for release being collected separately.

Historical trends So far as is known, Tromelin has never been subjected to a turtle fishery. It is very remote and landing is always treacherous, so that ships rarely if ever visit the island. A few shipwrecked sailors have subsisted briefly on turtles.

LEGISLATION

See under EUROPA.

THREATS

Introduced rats and rabbits have been cited as threats to habitats on Tromelin, and the lighthouse is likely to disorientate emerging hatchlings and perhaps nesting females (unpublished comments on 1985 CITES Proposal). Following these suggestions, a deflector was fitted to the light beacon in 1986 (Anon., 1987a), but it was totally ineffective as it was too small and its shade only extended to within 17 m of the buildings. The rat population was largely destroyed by a cyclone which inundated the island in 1985, but a few remain (Anon., 1987a). The harvest of turtles nesting on Tromelin in Madagascar and Mascarene waters may present a threat to nesting numbers, but this cannot be quantified at present. As on Europa, peak season nesting density is high and some nest destruction by female turtles occurs, varying between years (Bonnet in litt., 22 April 1987).

ILES GLORIEUSES

POPULATION: Chelonia mydas

Nesting sites The main island has some 6 km of "ideal undisturbed beach" (Frazier, 1975).

Nesting numbers Frazier (1975) observed 413 nest pits on the main island and counted 21 new nests (representing 15 females at most) during a month (in January-February 1972). He estimated the annual maximum at around 250 females. Hughes (1976) estimated the annual total at around 100 females annually, and later (1982, citing Vergonzanne, then in press) at 70-80 females. Vergonzanne et al. (1976) reported a total of 60 turtles emerging between June and August 1973, with a mean total of less than one female nightly, and characterised the population as poor. Observations by the meterological staff revealed nearly 30 tracks in a single night in 1986 (Anon., 1987a).

Trends in nesting numbers No numerical data are available. Bonnet (1984) indicates that numbers appear to have increased since most of the human colonists departed (leaving only a small staff at the meteorological station).

Nesting season Vergonzanne (1974, unpublished) recorded maximum nesting in May-July. Frazier (1975) suggests that nesting activity is likely to be at a peak in June-July, corresponding with the peak on nearby Aldabra (Seychelles).

Migration Frazier (1975) commonly saw groups of turtles offshore and suggests that the island is a transit point in migrations between feeding and breeding areas.

POPULATION: Eretmochelys imbricata

Frazier (1975) records finding three E. imbricata nests, presumably fresh, and 23 nest pits, during his month's visit in January-February 1972. He estimates the annual nesting total at around 50. The main island has a very large reef area which would be likely to provide suitable foraging grounds. Bonnet (1986) notes that no nesting by this species was observed by Vergonzanne during a prolonged stay on the island in 1973-1974.

THREATS

Frazier (1975) believes that the large population of ghost crabs Ocypode spp., which burrow into nests and consume hatchlings, is responsible for the very low level of turtle nesting activity, despite apparently suitable conditions. Frazier (1975) noted that his informants in the Seychelles spoke of large numbers of C. mydas having been taken in the Iles Glorieuses some years ago; no details of the intensity of past exploitation are available, and the extent to which it may have posed a threat is not clear.

JUAN DE NOVA, BASSAS DE INDIA

According to Bonnet (1986), C. mydas nests on Juan de Nova but probably not at Bassas de India; both islands are located in the Mozambique Channel. Bonnet (1984) noted that scarcely any turtles had nested on Juan de Nova over the last decade or so, and attributed this to the long-term presence of human colonists (for exploitation of guano and palms). Recent information (Anon., 1987a) suggests that nesting numbers may have begun to recover. Populations do appear to have been greater in the past; Petit (1930) noted that Malgache fishermen formerly (i.e. before 1930) visited Juan de Nova to take marine turtles, and that the shoreline at that time was a veritable graveyard of turtle bones.

Virtually no recent information is available. Chelonia mydas has been recorded as nesting on São Tomé, Principe and Rolas (an islet off the south coast of São Tomé), and E. imbricata has been recorded on São Tomé and Rolas (sources cited in Brongersma, 1982). According to Greef (1884), the beaches of São Tomé and especially Rolas, were "very commonly" visited by nesting C. mydas and E. imbricata between December and February (Greef's footnote, 1884, page 49, appears to be the main source of information on turtles on these islands).

EXPLOITATION

Commodity Greef (1884) noted that nesting females of both species were taken on the nesting beach, meat and eggs of C. mydas being most highly regarded. E. imbricata was said to be less favoured for food, but the locals on Rolas apparently ate it without ill effect. Its shell was used in the manufacture, apparently local, of jewellery and other ornamental items. Parsons (1962) stated that a small tortoiseshell industry was said to exist on the islands. Reiner (in Brongersma, 1982) reported that E. imbricata is at present heavily exploited in São Tomé, for the souvenir trade. These islands appear to be a centre for E. imbricata exploitation.

Domestic trade The polished carapaces of C. mydas and E. imbricata were reported to be on sale in tourist shops for Db8000 each (approx. US$40) together with some Hawksbill shell jewellery, but there was little other evidence of trade (P.J. Jones in litt., 2 September 1987).

International trade São Tomé and Principe are not a Party to CITES, and there are no records of trade in turtle products from these islands recorded in CITES Annual Reports. However, Hawksbill shell clearly is commercially exported as Carr and Carr (1985) were told that all tortoiseshell goods on sale in Luanda (Angola) were imported from São Tomé.

LEGISLATION

It appears that turtles are not legally protected in São Tomé and Principe.

SAUDI ARABIA: GULF

POPULATION: Chelonia mydas

Nesting sites Most nesting occurs on the following offshore islands, in descending order of importance: Karan, Jana, Kurayn, Jurayd. About 80% of the Saudi Gulf nesting population of *C. mydas* uses Karan (Basson *et al.*, 1977). Another source (Burchard, undated, 1982?) states that about 80% of nesting (all species) occurs on Karan plus Jana. Some nesting occurs or occurred on the mainland (early 1970s), but this is likely to have now been reduced or eliminated due to industrial and other development (Burchard, 1982).

Nesting numbers A combination of daily nest counting on Jana plus aerial survey of body pits, suggested an approximate total of 3000 females using the six Saudi coral islands in 1973 (Burchard, 1982). A later estimate (Burchard, undated, 1982?) suggests a total nesting population of 12 000-15 000 adults; if it is assumed that this is intended to include adult males (which may not be the case), and that one third of the total population breeds in any given year, an approximate total of 2000-2500 nesting females per season is suggested.

Results of more recent survey work (Miller, in prep.) are not yet available. Ross (*in litt.*, 29 December 1986) notes that these data confirm that published estimates are the correct order of magnitude: published estimates include "gatherings of several hundred individuals in the vicinity of certain offshore islands" (Basson *et al.*, 1977), or around 500 females annually, or more than 1000 (Ross and Barwani, 1982; Table 2 and Figure 1, respectively).

Trends in nesting numbers Trends in nesting numbers are not known. Several factors likely to have an adverse impact on nesting numbers are evident (Basson *et al.*, 1977; Burchard, 1982 and undated 1982?)

Nesting season April-September (Basson *et al.*, 1977).

Foraging sites Adult and half-grown turtles are often seen throughout the year on seagrass pastures between Safaniya and al'Uqayr, and are commonly found in Tarut Bay (where they are sometimes caught in shrimp trawls) (Basson *et al.*, 1977). There are over 1000 sq. km of suitable seagrass pastures, which form a major feeding area in the Gulf (Ross and Barwani, 1982). However, the majority of nesting turtles appear to migrate to more distant feeding grounds.

Migration Turtles present in Saudi Gulf waters include a migratory component, comprising the majority of Green Turtles in the area, which nest on the Gulf islands and migrate to foraging areas elsewhere, and a small resident component (IUCN, 1987b).

POPULATION: Eretmochelys imbricata

Nesting sites Nesting occurs on the same offshore islands used by Green Turtles: Karan, Jana, Kurayn, Jurayd. Similarly, Karan is the major site, followed by Jana (Burchard, undated, 1982?).

Nesting numbers No details available. Although "fairly common" in the Gulf it is "much less abundant" than the Green (Basson et al., 1977). Ross and Barwani (1982) estimate that around 100 nest annually.

Trends in nesting numbers Trends in nesting numbers are not known. Several factors likely to have an adverse impact on nesting numbers are evident (Basson et al., 1977; Burchard, 1982 and undated 1982?) and the population is likely to be under some pressure.

Nesting season Most nesting occurs April-July.

Foraging sites No direct information, but typically associated with coral reef habitats and may forage around the coralline nesting islands.

THREATS

Exploitation appears not to be a significant threat, although turtle consumption by Asian contract labour may now be a cause for concern (Basson et al., 1977; Burchard, 1982).

Industrial and other development has reduced turtle nesting on the Gulf coast. Dredging and landfill operations have been very extensive: most formerly important mangrove stands no longer exist, tidal flats and seagrass areas have also declined in extent (Burchard, 1982). Plans have been proposed for a major oil storage and processing facility on Jana and, apparently, a Coast Guard base on Jurayd. The nearby island of Jubail is becoming a major population centre (Burchard, undated, 1982?) and a previously major nest beach now has no nesting (Ross in litt., 29 December 1986). Tar and oil appear to be ubiquitous but the impact on turtles is as yet unquantified (Ross in litt., 29 December 1986).

Shrimp trawlers sometimes catch turtles incidentally, in Tarut Bay for example (Basson et al., 1977) and often work over seagrass beds. This pressure is likely to increase in parallel with increased fishing effort as shrimp stocks decrease (Burchard, 1982; Ross and Barwani, 1982). The demersal trawl fishery is also increasing, including in the immediate vicinity of the nesting islands (Burchard, 1982).

EXPLOITATION

Commodity Most of the turtle exploitation appears to be for local consumption. Eggs are collected from the nesting beaches, and a few females may be killed for meat or to extract unlaid eggs (Basson et al., 1977).

Hunting intensity The level of exploitation appears to be relatively light: "only small numbers of nesting female green turtles are caught on the beaches by local fishermen" (Basson et al., 1977). However, more recently, large numbers of Asian contract labourers (e.g. from Korea and the Philippines), not subject to the religious constraints on turtle consumption affecting most of the Saudi population, are thought to pose an important threat. Of particular concern was the practice of transporting groups of labourers to offshore islands for weekend recreation (J.E. Burchard, in litt. to G.H. Balazs, 21 February 1982).

Domestic trade Turtle products from local populations are not known to be traded in Saudi Arabia. However, imported lacquered turtles (both

E. imbricata and C. mydas) are sold in several shops (M. Al-Deghaither in litt., 25 October 1986). Burchard (in litt. to G.H. Balazs, 21 February 1982) reported "hundreds" of small Hawksbills in local curio shops in the early 1980s.

International trade Turtle products are not generally exported, but small quantities of stuffed turtles are imported for the curio trade (M. Al-Deghaither in litt., 25 October 1986). These were thought to have been imported from Singapore (J.E. Burchard, in litt. to G.H. Balazs, 21 February 1982).

CITES Annual Reports indicate that Saudi Arabia is a minor consumer of manufactured turtle products. Italy reported exporting 96 pairs of shoes in 1980, 287 in 1981, 88 in 1982 and various other leather items to Saudi Arabia.

LEGISLATION

There is no current legislation specifically to protect sea turtles (M. Al-Deghaither in litt., 25 October 1986).

SAUDI ARABIA: RED SEA

POPULATION: Chelonia mydas

Nesting sites Most nesting (over 80%) occurs on offshore islands, the only significant mainland nesting takes place south of the cement factory near Ras Baridi, north of Yanbu. Three main nesting areas can be distinguished (IUCN, 1987a):

(a) Tiran Island and vicinity.
(b) The area between Wejh and Yanbu, including offshore islands and parts of the mainland.
(c) The islands of the north outer Farasan Bank, particularly the island groups centred on 19°50'N, and 18°15'N, which support relatively high density nesting.

Some islands and some parts of the mainland coast have not yet been surveyed for evidence of turtle nesting.

Nesting numbers Ground surveys of nesting tracks and body pits in 1982 and 1983 provided evidence of 291-750 Green Turtle nests (IUCN, 1984). This is may be an underestimate since some parts of the mainland and some islands were not covered and surveys of the Farasan Islands were carried out before the probable peak Green nesting period; on the other hand, some nests from the previous season may have been included in the count (IUCN, 1984). The most important single site is the 200-400 m beach near Ras Baridi, just north of Yanbu, where perhaps 100 females nest in a season (IUCN, 1987a). Available data suggest that the total annual nesting number is in the low hundreds.

Nesting season Nests in late summer to autumn (IUCN, 1984).

Foraging sites No specific information, though suitable habitat appears rather widespread.

Migration No specific information, but it has been speculated that the Red Sea Green Turtle population is independent of Indian Ocean populations (IUCN, 1984), and the local Green Turtles may be largely resident or undertake small movements between mainland feeding grounds and island nesting sites.

POPULATION: *Eretmochelys imbricata*

Nesting sites On present evidence, all Hawksbill nesting occurs on offshore islands. Three main nesting areas can be distinguished (IUCN, 1984 and 1987a).

(a) The vicinity of Tiran Island, in particular Sinafir, Shusha and Barqan.
(b) The offshore islands between Wejh and Yanbu.
(c) The islands of the north outer Farasan Bank, particularly the island groups centred on 19°50'N, and 18°15'N, which support relatively high density nesting.

Some islands and some parts of the mainland coast have not yet been surveyed for evidence of turtle nesting.

Nesting numbers Ground surveys of nest tracks and body pits in 1982 and 1983 provided evidence of 572-1369 Hawksbill nests. This suggests that a few hundred female Hawksbills may use these three nest sites.

Some 75% of these nest in the region extending between Al Lith and the Farasan Bank - notably Maghabiya, Mafsubber and Sabiya, in the southern part of the north outer Farasan Bank, 18°-18°30'N - and most of the remainder near Tiran, near the mouth of the Gulf of Aqaba. The Farasan Bank islands are the most important known site, with 200-400+ females a season (IUCN, 1984). This level of Hawksbill nesting is important at international level.

Nesting season Nests primarily in spring-early autumn (IUCN, 1984).

Foraging sites No direct information, although Hawksbills are noted in coral reef environments near nesting sites (IUCN, 1984).

THREATS

Whilst apparently at low levels at present, exploitation could pose a threat when occurring in given areas for long periods.

Little information available generally, but cement dust from the Yanbu cement plant is causing coral mortality in the area and has been reported to coat the nearby Green Turtle nesting beach (no data on the impact on turtles).

There is some incidental catch but this does not appear to be highly significant.

EXPLOITATION

Commodity There is probably little intentional exploitation of turtles in the region, although they may be taken periodically by fishermen for their own consumption while in fishing camps on the offshore islands. Eggs

are also collected (IUCN, 1984). A few sub-adult Hawksbills are reported to be kept as curiosities in ponds and fountains in Jeddah, where some have surprisingly survived for over a year (J.P. Ross in litt., 29 December 1986).

Hunting intensity Exploitation levels appear to be minimal, but this may add up to significant pressure over the years, and may contribute to the general correlation between low human activity and high turtle nesting activity. The absence of turtle nesting from Seil Makawa Island was attributed to the presence of a large fishing camp. The large immigrant labour force employed at Yanbu Industrial City is said to pose a threat to the local turtle nesting populations, as some of the expatriates are reported to have been collecting eggs and possibly nesting females (IUCN, 1984).

Domestic trade There is little, if any, local trade in turtle products, although there are unconfirmed reports that turtle meat may occasionally be sold in Jeddah fish market (J.P. Ross in litt., 29 December 1986).

International trade A few stuffed turtles are imported for sale in curio shops. See comments under SAUDI ARABIA: GULF.

LEGISLATION

See under SAUDI ARABIA: GULF.

POPULATION: Chelonia mydas

Nesting sites Although C. mydas is commonly encountered along the coast of Senegal, confirmed nesting sites are few, and the country appears to be more important in providing foraging grounds. Reported nesting locations include, the Langue de Barbarie N.P. (at the mouth of the Senegal River, near St Louis on the border with Mauritania), unspecified points on the coast between St Louis and Dakar, Somone, Joal, Sangomar Point, and islets in the Saloum delta (Maigret, 1977 and 1983). Much of the coast is remote and remains unsurveyed.

Nesting numbers Little information is available, but on present evidence (Maigret, 1983; Dupuy, 1986) numbers would appear to be low to very low. No large nesting aggregations are known (Maigret, 1978). According to Dupuy (1986), most nests in 1985 were found at Sangomar Point and in Saloum Delta N.P.; however, almost all observations listed by Dupuy are of fewer than five nests, mostly by species unidentified. Dupuy reported about 20 confirmed nestings in Senegal in 1985 (this appears to include at least three species).

Trends in nesting numbers Turtle numbers are reported to be declining in Senegal (Maigret, 1977; Dupuy, 1986). Maigret (1983) cited information from local inhabitants of the Langue de Barbarie N.P. that 20 years ago around 200 nests were laid each season, but fewer than ten nests had been seen in the late 1970s, and only two in 1977. According to Dupuy, there were a minimum of 200 nestings on the Senegal coast in the 1950s, about ten a year after 1950, and about 20 in 1985. Dupuy's statement, apparently referring to all species and all Senegal, appears to correspond closely with Maigret's statement, referring to C. mydas and the Langue de Barbarie N.P. alone.

Nesting season Nesting in the Langue de Barbarie N.P. is mostly between July-August, and some nesting in the Saloum area occurs in February-March (Maigret, 1977). Dupuy (1986) reports nesting in July-October and January-March.

Foraging sites The species appears to occur along much of the Senegal coast, where abundance is closely linked to the distribution of seagrass pastures; highest numbers seem to occur near the mouths of the Casamance and Gambia rivers, the channels of the Saloum delta, and the Joal region (Maigret, 1983).

Migration The C. mydas population in Senegal appears to be partly migratory (Dupuy, 1986), but no detailed information is available.

POPULATION: Eretmochelys imbricata

Very little information is available. The species has been recorded in Senegal waters, although quite rarely; while no confirmed nest sites are known, sporadic nesting may well occur on remote beaches. Previous records of the species are from Hann and Dakar; more recent records are from the Saloum delta, Cap Skirring and Casamance; it is caught in the Saloum delta by fishermen from Betenti (Maigret, 1983). According to Dupuy (1986), while E. imbricata occurs along much of the Senegal coast, numbers are highest south of Mbour.

SENEGAL

EXPLOITATION

Commodity C. mydas is captured by villagers along the Senegal coast, particularly around Saint-Louis, Cap-Vert, Saloum and Casamance (Maigret, 1977). E. imbricata is said to be taken by the Betenti fishermen in the Saloum delta (Maigret, 1983), although there is said to be no shell industry in the country (Maigret, 1977). Previously, most of the turtles were killed for subsistence use by the fishermen, but the meat is increasingly being sold commercially (Anon., 1981b). Villiers (1958) described how the heart of a turtle was carried as an amulet by some of the people in the Cap-Vert Peninsula, and was said to be able to cure heart disease.

Hunting intensity The current levels of exploitation were thought to be posing a serious threat to the local turtle populations Anon., 1981b). The rarity of E. imbricata was said to be attributable to the fact that it was hunted assiduously (Dupuy, 1986).

Hunting methods There are no reports of the methods currently practised, although turning females on the nesting beaches (Villiers, 1958) was once, and probably still is, popular. The turtle fishery operating out of Joal in the 1940s relied on turtles accidentally caught in shark nets (Brongersma, 1982).

Historical trends The hunting pressure, fuelled by commercial demand, is said to have increased recently in Senegal (Anon., 1981b). There are fears that the catch of turtles will have further increased as a result of the Sahelian drought, which has had the effect of increasing the demand for turtle meat and raising its price (Maigret, 1983). Cadenat (1949, cited by Loveridge and Williams, 1959) studied the turtle fishery out of Joal off Senegal from 1945 onwards, and found that out of a total of 296 turtles caught, 256 were C. mydas and 23 were E. imbricata (Villiers, 1958). Maigret (in litt., 8 September 1987) reported that C. caretta and L. olivacea were also caught in this region.

Domestic trade There is apparently a good tourist market for turtle carapaces (Anon., 1981b; Verschuren, 1985).

International trade Verschuren (1985) implied that turtles caught off Mauritania were sold in Dakar, Senegal. Apart from scientific specimens, the only evidence of turtle trade contained in the CITES Annual Reports was a single specimen of "Cheloniidae" reported as imported to Switzerland in 1981, possibly indicative of a minor tourist trade.

LEGISLATION

Game and Wildlife Protection Regulations, 30 May 1967.
Prohibits the possession and trade of Testudines, including sea turtles.

Marine Fisheries Code, 2 July 1976.
Prohibits the taking, possession and sale of all species of sea turtle.

Loi No. 86-04, Code de la chasse et de la protection de la faune, 24 January 1986.
Article D.36 lists certain species which are totally protected. These may not be hunted or captured throughout the territory except under scientific permit, and the collection of eggs is also forbidden. The list includes sea turtles of the genera: Chelonia, Caretta, Lepidochelys, Eretmochelys and Dermochelys.

POPULATION: Chelonia mydas

Nesting sites The species is very widely distributed in the Seychelles, and some level of nesting is likely to occur on most islands in the group (Frazier, 1984). However, more nesting occurs in the southern group of islands (Aldabra-Providence) than in all other parts of the Seychelles combined, and major nesting is mainly restricted to Aldabra atoll (Mortimer, 1984). See next section for named sites.

Table 173. Estimates of C. mydas annual nesting numbers in each island group in the Seychelles (data from Frazier, 1984; Mortimer, 1984), with the estimated annual harvest of both sexes of C. mydas in the Southern Islands from January 1981 until September 1983 (Mortimer, 1984).

	Frazier (1984) Nesting	Mortimer (1984) Nesting	Mortimer (1984) Harvest
Granitic Seychelles	30	1-10	
Bird and Denis	20	10-20	
Platte	5	0	
Coetivy	5	30-50	
Amirantes			
African Banks	100	1-10	
Remire	5	1-10	
D'Arros	5 (incl St.Joseph)	5-20	
St Joseph Atoll	-	5-10	
Sand Cay	-	0	
Poivre	5	5-10	
Etoile	50	15-30	
Boudeuse	50	15-30	
Marie Louise	25	1-10	
Des Neufs	50	1-10	
Desroches	10	10-30	
Alphonse	50	5-10	
St Francois and Bijoutier	50	15-30	
Sub-total	400	79-210	
Southern Islands			
Providence	25	0-5	20 +
Cerf	25	15-25	?
St Pierre	0	-	-
Farquhar	50	400-450	100-123
Aldabra	1 000	1 980-2 420	0
Assumption	100	160-240	75 +
Astove	500	300-600	107-123 +
Cosmoledo	400	560-725	198-221
Sub-total	2 000	3 415-4 465	480-542 +
TOTAL	2 560	3 535-4 755	

Nesting numbers Two marine turtle field biologists have spent extended periods in the Seychelles: Frazier in 1972-1973 and Mortimer in 1981-1983; both published reviews in 1984 of turtles in the Seychelles, largely reflecting their own field research. For comparative purposes, nesting estimates of both authors are given in Table 173 (Mortimer's data are based on more field time and may thus be generally more representative).

Mortimer (1984: p. 16) characterises the C. mydas population as follows: Granitic Islands - virtually extinct; Amirantes - fairly rare; southern islands - numerous (on some).

Trends in nesting numbers Direct evidence is sparse, but trade data, with verbal and written reports, strongly suggest a general decline in nesting numbers, dating in places from the middle of the last century. Both Frazier (1984, Fig. 14) and Mortimer (1984, Fig. 19) have graphed the annual weight of calipee exported (converted into approximate turtle-equivalents) between 1907 and 1968/1970 (data first compiled by Stoddart, 1976). The late 1960s export figure is around 20% of the late 1900s figure, with a rather steady decline throughout the intervening years (with two clear troughs corresponding to World War I and World War II). This decline in export volumes is likely to represent a parallel decline in C. mydas population levels, due to over-exploitation.

An 1846 source, cited by Mortimer (1984: p. 17), reported that C. mydas were common at the time of his writing but had formerly been more abundant. Turtles were regularly found (and captured) around Praslin and Mahé 20 years ago, but are now seen there only rarely. While the species appears to have declined around the Granitic Islands, the former intensity of nesting in the area is not known. According to Hornell (1927), the species had been "fairly numerous" in the northern islands, but always much less abundant than in the south; the species had virtually deserted the Mahé group by the 1920s.

South of the Granitic Seychelles, historical records (cited in Mortimer, 1984) suggest that large numbers of C. mydas nested in the Amirantes. A ship's log reports that 32 females were taken in one night in 1770, probably on Poivre; only 5-10 are estimated to nest in one year on Poivre at present; but the island manager reports that 16 years ago about twice as many were nesting. On Coetivy, eight turtles were taken in one night in 1788 and 51 in five or six days; at present there are an estimated 30-50 in one year (Mortimer, 1984). The species was still numerous in the 1920s, but less common than at the turn of the century (Hornell, 1927).

Numbers appear to have declined also in the southern islands; the C. mydas commercial harvest for calipee appears to have been largely based in this group, and to have become intense at the time of the colonisation of Aldabra and Assumption in 1906-1907 (Hornell, 1927). On Assumption, which formerly rivalled Aldabra in C. mydas nesting numbers, 200 turtles were seen to be nesting on a single night in the mid-1900s, and "at a rather earlier date" up to 300 were taken in a night (sources cited in Hornell, 1927). The daily harvest around 1906 was some 150 turtles, but the catch was reduced to 5-6 per day by 1916 (equivalent to about 2000 annually), and to about 1100 per year around 1925 (sources cited in Stoddart, 1976). More recently, estimated numbers nesting per year were 100 in the early 1970s (Frazier, 1984), and 160-240 in the early 1980s (Mortimer, 1984). In other words, the number of females nesting in a year at present is approximately equal to the numbers that nested in one night at the turn of the century. Although turtles cropped in former times were taken in part by harpoon at sea (and

would thus have included males and non-breeding females, and in greater proportion during the courtship period before the peak nesting time), the bulk of the harvest consisted of females taken from the nesting beach.

Assumption is a small island with extensive guano deposits that have been heavily mined for many decades; the resident labour force is settled adjacent to the main nest beach. The collapse of the Assumption nesting population can be attributed to the ease with which turtles could be harvested. In contrast, there are some 50 nest beaches on Aldabra, and access to more remote parts of the atoll remains difficult; these are among the factors which have allowed a substantial C. mydas population to persist (Mortimer, 1984). However, according to Mortimer (1984) the present population is probably one-third to one-fifth that at the turn of the century. Tables 174 and 175 compares estimated numbers cropped with estimated annual nesting numbers, on Assumption and Aldabra respectively.

Table 174. Estimates of numbers of C. mydas harvested and numbers nesting on Assumption at different periods (data from Hornell, 1927; Wheeler, 1953; Mortimer, 1984).

Year	Number harvested	Number nesting
c. 1900	up to 200-300 nightly	could represent around 5000 females annually
1910	50 a night	could represent around 1500 females annually
1924	1131 a year	
1925	1108 a year	
1926	1064 9 months	
1948	c. 100 in "the season", perhaps 2-3 months	could represent a few hundred females annually
1980s	75 +	c. 200 females annually

The interpretation of these data rests largely on the extent to which harvest figures are equivalent to nesting numbers, and on the size of the nesting population in the early years of this century. Hornell (1927), reported that in the early years of the Green Turtle fishery, turning females on the nest beach was the main collecting method. Mortimer argues that a large proportion of the numbers harvested on Aldabra, apparently up to 3000 annually, were probably females, and that because of transport and access difficulties, the number harvested is likely to be less than half the total nesting number; on this basis she suggests that 6000-8000 may have nested annually on Aldabra during the peak trading period (c. 1908). If these arguments are accepted, and it certainly seems unquestionable that not every turtle nesting on Aldabra's scattered nest beaches could be harvested, then a marked decline in nesting numbers is evident. Hornell (1927) reported that "several hundred" females would nest nightly on Aldabra at the height of the season. There appears also to be a sustained upward trend in

Table 175. Estimates of numbers of turtles harvested and numbers nesting on Aldabra (data from Hirth and Carr, 1970; Frazier, 1975; Frazier, 1984; Mortimer, 1984, 1985 and 1988a; Wheeler, 1950; Stoddart, 1966).
[1] = figures from Mortimer, 1985; [2] = figures from Mortimer, 1988a. The latter are calculated on the assumption of 5.5 clutches per female per year.

Year	Number harvested	Nesting emergences	Number nesting	
1890	700			
1895	1000			
1906	500-3000 ?			
1908	3000 ?		6000-8000?	
1925	1000			
1939-40	3000			
1948	400			
1960s	400		fewer than 1000	
1970			up to 1000	
1973			increased nesting	
1975			700	
1981		10 945-13 708	1900-2500 [1]	882-1556 [2]
1982		11 411-13 923	2030-2675 [1]	946-1598 [2]
1983		12 410-16 396	2210-2915 [1]	974-1896 [2]
1984		12 847-18 454		1083-2148 [2]
1985		10 083-13 096		820-1452 [2]

the 1980s, probably attributable to protection of mature females on Aldabra since it was made a nature reserve in 1968, and to a nation-wide ban on hunting of *C. mydas*, lifted in 1976.

In other parts of the southern islands, past exploitation has been heavy on Astove, and turtle hunters in the area report a decline in *C. mydas* nesting on Cosmoledo over the past 20 years, especially near the one settlement (Mortimer, 1984).

Nesting season Significant levels of nesting on Aldabra have been recorded throughout the year, with a peak in May-September (maximum July) and a minor high in March (Mortimer, 1984). The peak period appears to coincide with the onset of the south-east trades, around June (Frazier, 1984). Hornell (1927) suggested that different populations might have been nesting at different times of year; in the mid-1920s the main nesting season was February-May, the secondary season in May-September; according to Hornell, mating commenced in November, with the arrival of the main breeding herd, and extended through to January.

Foraging sites Reef flats and shallow-water seagrass pastures are widespread in the Seychelles; no information is available on favoured foraging sites. Hornell (1927) reported that suitable shallows are not extensive in the southern islands, including Aldabra.

Migration Little direct evidence is available. There is some local movement between islands, e.g. Cosmoledo to Astove (Mortimer, pers. comm.). It is suspected that Aldabra *C. mydas* migrate southward to foraging grounds

around the Mozambique Channel (Hornell, 1927), and local informants suggest that turtles may move from Aldabra to Assumption (this is a local movement involving only some 30 km) (Frazier, 1984). One turtle tagged at Aldabra has been recaptured in Tanzanian waters (Mortimer, pers. comm.).

POPULATION: Eretmochelys imbricata

Nesting sites Nesting is very widespread in the Seychelles, having been reported on more than 20 islands, from each main group; any suitable beach in the Seychelles is likely to have some E. imbricata nesting (Frazier, 1984). Nesting appears to be insignificant on Assumption, Astove, St Pierre and Providence, all in the southern islands (Frazier, 1984, Table 3; Mortimer, 1984, Table 7). Most E. imbricata nest in the Granitic group of islands, fewest in the southern group (Aldabra Providence). Hornell (1927) reported the same pattern of nesting density in the 1920s. Contrary to Frazier (1984), Cousin seems unlikely to have the largest known concentration of nesting E. imbricata in the western Indian Ocean; according to Mortimer (1984), numbers are far higher on St Joseph Atoll, Platte and Coetivy. See next section for named sites.

Nesting numbers Two turtle fieldworkers have spent extended periods in the Seychelles: Frazier (1984) in 1972-1973 and Mortimer (1984) in 1981-1983; both workers have recently published results of their work. For comparative purposes, nesting estimates by both authors are given in Table 176 (Mortimer's data are based on more field time and may thus be generally more representative). On this evidence, the Seychelles E. imbricata population is the largest in the western Indian Ocean.

Trends in nesting numbers Little direct information is available, but trade data and verbal reports strongly suggest a general downward trend in nesting numbers during the present century. Mortimer (1984, Fig. 11) has graphed the annual export weight of raw tortoiseshell (converted into approximate turtle-equivalents), and the price earned per kg, between the 1890s and the 1980s. Grouped into five-year means, these data show that shell exports had declined overall from 1894 to 1960, but rose steeply in the period between 1961 and the early 1980s. According to Mortimer (1984, p. 12) the apparent decline in the numbers of E. imbricata harvested annually up to 1960 "is probably attributable to an over-all drop in the size of the Hawksbill population as a result of over-harvesting". The sudden increase in numbers harvested from 1961 is attributed by Mortimer to an increase in the price of shell and improved hunting techniques (use of masks, snorkels, and outboard motors). Mortimer (1984, p. 13) also cites field observations made by R. Salm; on average he encountered one Hawksbill in every 1.5 dives around Mahé, Praslin and La Digue in 1976, but only two in 15 dives in 1983. In addition, virtually every fisherman and turtle hunter interviewed by Mortimer reported a significant decrease in the number of E. imbricata encountered around the Granitic Seychelles and the Amirantes.

Nesting season Most nesting on Cousin occurs between October and January (during the north-east monsoon), with a peak in November-December, but with some nesting recorded in most months (Frazier, 1984). In the Seychelles generally, most nesting is in September-November (Hornell, 1927).

Foraging sites The species is likely to occur widely in the Seychelles, particularly wherever rich coral reefs exist; Baie Ternay (Mahé) and the

Table 176. Estimates of E. imbricata annual nesting numbers in each island group in the Seychelles (data from Frazier, 1984; Mortimer, 1984). The average annual harvest declared at police stations for 1980-81, 1981-82 and 1982-83 is also given. The figures for the Granitic Islands represent a harvest of females only, while those for the remaining islands are for both sexes (Mortimer, 1984).

	Frazier (1984)	Mortimer (1984)	
	Nesting females	Nesting females	Declared harvest
Granitic Seychelles			
(here including Bird and Denis)			
Mahé	25		
unprotected beaches	-	171	105
protected beaches			
south-east	-	20-40	0
Baie Ternay	-	15	0
Satellite islands of Mahé	25		
St Anne (protected)	-	55-70	0
Moyenne (protected)	-	12	0
Cerf (protected)	-	2	0
Ile Anonyme	-	20	0
Praslin	5	65	70
La Digue	25	60	65
Felicité	-	20	3
Gran Soeur	25	20	(
Petite Soeur	25	20	(16
Marianne	-	10	7
Frigate	25	20	5
Silhouette	10	25	14
North Island	5	25	21
Bird and Denis	20	22	14
Cousin (protected)	30-40	20-30	0
Cousine (protected)	10	10-20	0
Curieuse (protected)	5	20-30	0
Aride (protected)	25	5-10	2
"others"	50	-	57
Sub-total	315	537-807	379
Amirantes			
African Banks	10	20-30	1
Remire	25	10-15	5
D'Arros	10 (incl St. Joseph)	25-40	0
St Joseph Atoll	-	80-100	0
Sand Cay	-	5-15	23
Poivre	20	35-70	43
Etoile	15	15-30	3
Boudeuse	15	10-25	0
Marine Louise	5	10-20	0
Des Neufs	5	15-35	0
Desroches	15	30-50	4
Alphonse	10	20-40	1
St Francis and Bijoutier	20	30-50	0
Sub-total	150	305-520	80

Table 176. continued

	Frazier (1984) Nesting females	Mortimer (1984) Nesting females	Mortimer (1984) Declared harvest
Platte	10	60-70	1
Coetivy	30	150-300	0
Sub-total	40	210-370	1
Southern Islands			
Providence	10	0-5	2
Cerf	10	20-40	0
St Pierre	0	-	-
Farquhar	20	20-35	7
Aldabra	10	30-40	0
Assumption	0	0-5	0
Astove	0	0-5	1
Cosmoledo	14	15-25	15
Sub-total	64	85-155	25
TOTAL	529	1 137-1 852	485

reef flat at La Saline (Cousin) are said to be frequented by feeding turtles (Frazier, 1984).

Migration Little information is available. Frazier (1985) reports that five of the 55 females that had been tagged on Cousin up to 1976 were later recovered, on Grande Soeur and in west Praslin (all within less than 30 km of Cousin). Philipps and Wood (1983) record a further nine tags from Cousin recovered from turtles killed in the Praslin area. The extent to which *E. imbricata* move between nearby islands, or between island groups, remains unknown.

EXPLOITATION

Commodity Hawksbill Turtles have long been killed in the Seychelles for their shell. Their meat is not usually consumed as it is believed to be poisonous, although no documented fatalities have occurred in the islands. The females are preferred because they have thicker carapaces and therefore more valuable shell. Green Turtles are widely hunted for meat, either for local consumption or for sale in nearby markets (Mortimer, 1984). Various products other than meat have been obtained from Green Turtles. These include calipee (gelatinous cartilage used mainly for soup), quitouze (dried meat), cawan (carapace plates from the plastron, used in South East Asia as window panes), oil, bones and blood (Stoddart, 1984). Female turtles are generally preferred on account of their higher fat content (Mortimer, 1984). Turtle blood is considered to have medicinal properties and is sometimes consumed directly from the artery (Stoddart, 1984). Nests are rarely dug up, but eggs from slaughtered females are said to be readily consumed (Frazier, 1980a). Turtle oil has or had a local reputation for the treatment of pulmonary tuberculosis (Wheeler, 1953).

Hunting intensity The numbers of C. mydas harvested in the southern islands have been estimated by Mortimer (1984) and the annual averages are given in Table 173. The average sex ratios (M/F) were 2.39 on Cosmoledo, 0.54 on Astove, and 1.08 on Farquhar. Mortimer (1984) estimated that this represented annual harvests of 8-13%, 10-25% and 13-19% of the nesting female population for the three islands respectively.

In 1979, the Government revived an old regulation requiring fishermen to declare to the police stations the numbers of Hawksbills that they had caught. Harvests in the Granitic Islands alone amounted to 560 in 1980-81, 537 in 1981-82 and 647 in 1982-83. The average declared harvests from 1980 to 1983 are given in Table 175. On several of the islands, Mortimer was able to confirm that the true numbers of E. imbricata captured were considerably higher than the declared figures. Furthermore, the declared harvests from 1979 to 1983 represented only 47-58% of the tortoiseshell that was known to have been exported over the period. Mortimer (1984) concluded that on the Granitic Seychelles the vast majority of females that came to nest each year were killed. Mortimer's (1984) report included recommendations that the killing of all female Hawksbills should be prohibited, that males should be harvested under a quota system and that exports of raw shell should be prohibited. In 1985, a proposal was submitted to the 7th meeting of the Conference of the Parties to CITES to transfer the Seychelles population of E. imbricata to Appendix II. The proposal claimed that the Government had approved these recommendations and that they had been "added to the Seychellois law", although no legislative texts have been located to confirm this (see below). In spite of this, it appears that females continue to be killed in the Seychelles (Mortimer, pers. comm.).

Hunting methods Harpooning and turning females on the beaches are the traditional methods of capture. Nets are said not to be used (Frazier, 1980a). Formerly, all turtles were harpooned from the surface, either with a wooden harpoon or else with a lead-weighted "baton-fon" which was used to spear animals seen (using a glass-bottomed box) resting near the sea bed. The introduction of face masks, around 1960, enabled fishermen to dive below the surface to spear turtles, and this greatly increased the hunting efficiency. Spear guns were also used for a while until their use was banned (Mortimer, 1984).

Historical trends The past history of Green Turtle exploitation in the Seychelles has been the subject of some controversy. Frazier (1974) claimed that some 12 000 had been harvested from Aldabra in 1890, and that harvests had declined substantially since then. Stoddart (1976) systematically reviewed Frazier's data and produced the revised estimates given in Table 176. He concluded that there was no continuous cropping of C. mydas on Aldabra before 1890. Although according to Hornell (1927) Green Turtles had been sent from the southern islands to Mahé, for local meat consumption, since at least the 1850s, the intensity of this harvest is now uncertain; the more concentrated trade for calipee dates from the mid-1900s. Exploitation on Aldabra ceased in 1968, when it became a nature reserve. Green Turtle calipee and other products were formerly exported in large quantities, and the Customs statistics shown in Table 177 indicate that the volume has declined substantially since the beginning of the century. At the peak year, 1912, 16 762 kg of calipee were exported, which Stoddart (1976) estimated was equivalent to 11 175 turtles. The numbers of turtles used for domestic consumption have not been calculated, although it is possible that they could largely have been included in this total, as the

meat could have been eaten while the calipee from the same turtles was preserved for export.

The history of Hawksbill exploitation is easier to document as the only significant product, tortoiseshell, was nearly all destined for export. In 1786, Malavois (fide Hornell, 1927) reported that 1000-1200 lbs (455-545 kg) of tortoiseshell were exported annually. As early as 1842, the Civil Commissioner investigated reports that turtles were being depleted by over-exploitation for shell on Aldabra (Stoddart, 1976). Customs figures (Table 177) show that exports fluctuated between zero and 2.8 t since 1894, except for a figure of over 4 t in 1919 which probably represents the export of stockpiles accumulated during the War. The levels of harvest are more difficult to interpret. Mortimer (1984) pointed out that the figures could be divided into two periods: from 1894 to 1959, there appeared to be a general decline, which she attributed to declining turtle populations; and from 1960 onwards, a marked increase, which she claimed resulted from improved fishing techniques, notably the introduction of snorkelling. This interpretation is probably too simplistic, and it is likely that economic factors played an important role in determining the levels of harvests. The price of shell fell until 1959, roughly in line with the falling exports (Table 177). This implies not that the supply (i.e. the turtle population) was declining but that the market demand was falling. The year 1960 was marked by a doubling in the price of shell, and it is probable that this stimulated the introduction of improved fishing techniques and increased harvests, rather than the reverse causal relation inferred by Mortimer. The price of shell began to climb very steeply in 1970, without an apparent rise in exports, and Mortimer (1984) interpreted this as evidence of a further fall in turtle populations. In recent years, the domestic tortoiseshell industry has been using increasing quantities of shell and young turtles for stuffing, and in 1981, the export of shell was prohibited except by the parastatal company Seycom. This company had a policy of progressively reducing the price it paid for raw shell in an unsuccessful attempt to control the harvest. In 1983, it stopped buying shell altogether (Mortimer, 1984), although there was no decline in the harvest of Hawksbills declared at the police stations (J. Mortimer in litt., 31 December 1987).

Domestic trade Turtles not used for local consumption are taken for sale in Mahé. Some are transported live, having been kept in ponds while awaiting the arrival of the boat, and others are slaughtered for the preparation of the dried "quitouze", which is easier to transport. The capture of Green Turtles was totally prohibited in 1968, and from then until 1976, few if any were sold in Mahé (Frazier, 1980a). In 1976, it was realised that the ban was unenforceable, and the killing and sale of male C. mydas was permitted, females remaining protected. Mortimer (1984) reported that in 1981, only live male turtles were transported to Mahé for sale, but that it was not always possible to determine the sex of meat transported as quitouze. Frazier (1980a) gave the price of meat in the late 1960s in Mahé as US$0.50 a kg or US$22-36 a turtle.

The historical price of Hawksbill shell is given in Table 177. In recent years there has been an attempt by the state company, Seycom, to manipulate the price of shell and thus the harvest of turtles. From January 1981 to November 1982, Mortimer (1984) reported that the price paid for backshell was Rs200 a kg, and Rs400 a kg for plastron and marginal scutes. The corresponding prices fell to Rs100 and Rs200 between November 1982 and January 1983, and then Rs50 and Rs100 for the next two months, before, in February 1983, Seycom stopped buying shell altogether (n.b. backshell is usually more valuable than that of the plastron).

Table 177. Export of turtle products from the Seychelles. E. imbricata: data from Mortimer (1984) show exports of raw tortoiseshell and its average value per kg. The equivalent number of turtles that this represents was calculated on the assumption that until 1969 the shell comprised a mixture of back shell, plastron and marginals (1.4 kg per animal), and from 1970 onwards, that it was only plastron and marginals (0.5 kg per animal). C. mydas: data from Stoddart (1976), many first compiled by Hornell (1927). The equivalent number of turtles that this represents was calculated assuming that each yields 1.5 kg of calipee.

Year	Eretmochelys imbricata			Chelonia mydas					
	Price Rs/kg	Raw Shell kg	Turtle equiv.	Calipee kg	Turtle equiv.	Quitouze kg	Cawan kg	Oil kg	Bones t
1883	17.21	?	?						
1894	28.85	1736	1240						
1895	41.45	1802	1288						
1896	38.66	1701	1215						
1897	38.99	1522	1087						
1898	32.00	1281	915						
1907	42.20	734	524	11208	7472		759	0	0
1908				7954	5303		883		28
1909				10187	6791		1448		4
1910	35.63	1053	752	12762	8485		0		0
1911				1892	1261		645	1581	150
1912				16762	11175		486	273	7
1913				5786	3857		538	2293	30
1914	37.58	614	439	9064	6043		415	3445	0
1915	29.11	475	317	2632	1755		0	0	4
1916	18.54	875	625	1389	926				0
1917	24.11	515	368	3610	2407	107			
1918	29.14	215	154	678	453	0			
1919	17.10	4034	2881	2220	1480	0			
1920	43.66	1280	914	1220	813	0			
1921	?	?	?	1810	1207	0			
1922	41.01	1242	887	853	0				
1923	38.25	1047	748	6750	4500	0	1740		
1924	50.66	1505	1075	9167	6111		0	464	
1925	50.58	1179	842	5640	3760	355	0	3480	
1926	48.54	984	703	4080	2720	-	1305		
1927	46.79	1171	681	5023	3349	997	878		
1928	30.81	1067	762	4165	2777	552	698		
1929	26.20	995	711	4226	2817	1314	663	580	
1930	25.53	1335	954	4120	2747	2567		2451	
1931	19.62	1008	720	4186	2791	2511			
1932	17.53	1434	1024	5743	3829	2337	504	2610	
1933	21.33	1191	851	4788	3192	1580	514	700	
1934	16.51	1104	789	3878	2585	751	109	400	
1935	12.71	742	530	4303	2869	5538	168	1151	
1936	12.83	1095	782	4456	2971		240	1383	
1937	11.80	896	640	4416	2944	2766	115	67	
1938	11.85	932	666	5407	3605	1086	241	244	
1939	11.29	756	546	2743	1829	562	324	3188	
1940	10.00	10	7	2379	1586	345		556	
1941	-	0	0						

Table 177. continued

Year	*Eretmochelys imbricata*			*Chelonia mydas*					
	Price Rs/kg	Raw Shell kg	Turtle equiv.	Calipee kg	Turtle equiv.	Quitouze kg	Cawan kg	Oil kg	Bones t
1942	38.62	148	106						
1943	19.26	475	339						
1944	18.05	1440	1029						
1945	30.57	314	224	2425	1617				
1946	22.35	1224	874	3017	2011	378	250		
1947	24.18	587	419	4287	2858	736			
1948	22.16	1767	1262	4214	2809	4097			
1949	11.93	810	193	540					
1950	9.32	879	628	2835	1890				
1951	12.31	1629	1164	2254					481
1952	5.84	25	18						
1953	7.27	1431	1022	1959	1306	600			
1954	9.43	455	325	448	299				
1955	8.21	334	239	2248	1499	1019			
1956	2.01	364	260	3780	2520	1260			
1957	5.56	825	589	5364	3576				
1958	7.42	1621	1158	774	516	3264			
1959	5.99	307	219	2180	1453	2988			
1960	10.48	905	646	3208	2139	2682			
1961	10.58	1243	888	4399	2933	271			
1962	15.59	1700	1214	1256	837	2435			
1963	11.50	2323	1659	1457	971	1339			
1964	22.61	1457	1041	634	423	1296			
1965	22.61	2407	1461			1503			
1966	27.36	1150	821	3349	2233	665			
1967	25.35	605	431	1794	1196	1567			
1968	27.64	1898	1356	1795	1197				
1969	31.77	1665	1189	99	66				
1970	40.57	2010	1436	820	547	320			
1971	69.63	1108	791						
1972	138.54	375	750						
1973	350.67	633	1266						
1974	258.73	1108	2216						
1975	186.69	600	1096						
1976	166.93	459	918						
1977	493.77	759	1518						
1978	494.98	1480	2470						
1979	529.67	968	1324						
1980	?	862	1724						
1981	205.74	2527	883-1805						
1982	817.82	591	1182						

International trade The early importance of the Seychelles was largely associated with its ability to supply turtle products for export markets. Historical export data are presented in Table 177. Exports of Green Turtle products ceased in 1968 when the species was protected, and so far as is

Table 178. Imports (in kg) of unworked bekko and other tortoiseshell reported in Japanese Customs statistics from 1969 to 1986, and the percentage of total exports from the Seychelles (from Table 177) that these represent.

	1969	1970	1971	1972	1973	1974	1975	1976	1977
Japan (Bekko)	22	449	275	0	0	136	177	106	523
" (Other)	0	0	0	0	0	0	0	0	54
% of Exports	1	22	25	0	0	12	29	23	76

	1978	1979	1980	1981	1982	1983	1984	1985	1986
Japan (Bekko)	976	1027	618	423	472	675	629	61	0
" (Other)	90	62	126	0	0	0	0	0	0
% of Exports	72	112	86	17	80				

known, they have not resumed, even though the protection has since been lifted.

Hawksbill shell continued to be exported until February 1983. The total value of tortoiseshell exports between 1971 and 1982 ranged from Rs51 951 in 1972 to Rs698 468 in 1980, representing between 0.55% and 2.47% of the total domestic exports from the islands (Mortimer, 1984).

Japanese Customs statistics have only reported imports of bekko since 1969 and of other tortoiseshell since 1977. The quantities reported are given in Table 178, together the percentage of the total exports from the Seychelles (from Table 177) that these represent. It can be seen that from 1977 onwards, Japan was the major destination of all exports. One reason for this is that the Seychelles acceded to CITES in 1977 but the Government remained under the mistaken impression (Anon., 1985d) that CITES regulations permitted them to export Appendix I Hawksbill shell to countries which held reservations on this species, and thus Japan remained one of the few countries still available to accept imports. The only other country whose Customs statistics were consulted to report imports of tortoiseshell from the Seychelles was Hong Kong, which reported importing 132 kg in 1978, and nothing else from 1974 until 1985.

The Seychelles acceded to CITES on 8 February 1977, and have submitted Annual Reports from 1978 to 1984. They only reported exporting products of E. imbricata, and the exports are shown in Table 179. A variety of CITES Parties, including Italy, Switzerland, USA, UK and F.R. Germany, have reported importing small quantities of turtle products from the Seychelles. The exports of shell to Japan are remarkably similar to the quantities of bekko reported imported in Japanese Customs statistics (Table 178) from 1978 till 1982. However, from 1983 onwards, the Japanese statistics recorded considerably greater volumes. This implies that some illegal exports continued without being recorded in the Seychelles CITES Annual Reports.

The Seychelles submitted a proposal to the 5th Meeting of the Conference of the Parties to CITES to transfer their population of E. imbricata to Appendix II. However, the Conference decided that the proposal did not meet the Berne Criteria, and it was rejected.

Table 179. Exports of products of E. imbricata reported in the Seychelles CITES Annual Reports. * In 1978, a total of 44 bodies of E. imbricata were said to have been exported to Argentina, Australia, Austria, Finland, India, Japan, Kenya, Luxembourg, Malta, Morocco, Netherlands, New Zealand, Nigeria, Norway, Saudi Arabia, South Africa, Sweden, USA and Zambia.

Year	Importer	Commodity
1984	Australia	1 kg body
1983	France	122 kg scales
	Japan	125 kg scales
1982	Austria	33 kg scales
	Japan	520 kg scales
1981	Japan	431 kg scales
	Mauritius	11 kg shells
	Singapore	110 g shells
1980	Italy	4 kg shells
	Japan	1065 kg scales
	Zimbabwe	1 kg live
1979	Japan	617 kg scales
1978 *	Australia	126 kg shells
	Belgium	26 bodies
	F.R. Germany	25 bodies
	France	143 bodies
	Italy	28 bodies
	Japan	1268 kg shells
	Spain	12 bodies
	Switzerland	10 bodies
	UK	13 bodies

LEGISLATION

Turtles Act 1925.

Applies to C. mydas and E. imbricata.

There is a minimum size for the taking of these turtles. The use of lights to catch or kill, and the use of underwater guns to kill turtles is prohibited.

The taking or sale of turtle eggs is prohibited.

The taking of turtles in the sea within 1000 m from high water mark is prohibited. (An amendment to the Act dated 23 November 1979 extended the distance from which turtles may not be taken around outer islands of the Seychelles to 16 km from high water mark)

Prohibits any person, other than the owner or lessee of land adjacent to the foreshore, or person authorised by him, to take or kill turtles on the foreshore of adjacent land.

Declarations must be made to the customs authorities of turtles killed or captured and permits obtained before such turtles may be slaughtered, sold, exported or otherwise dealt with. Permits may only be issued in respect of turtles that have been lawfully obtained.

The President is empowered to make regulations declaring closed season or to implement the provisions of the Act. The Minister is empowered to grant special licences to catch and rear turtles.

Victoria, Mont Fleuri and Mamelles Market Regulations, 1926.
The sale of C. mydas on public markets is authorised.
The sale of E. imbricata on public markets is prohibited, on account of the poisonous nature of its flesh.

Turtle Regulations, 1929, made under Section II of the Turtle Act of 1925.
Implements the Turtle Act of 1925.
Lays down the forms of declarations of turtle captures to be made under the Act.
Provides for the marking of hawksbill shell.
Female turtles caught on land or sea before laying eggs shall be carefully slaughtered in order to enable the eggs to be properly extracted and buried in the sand above high water mark.
Dealers in hawksbill shell must keep a register of their transactions.
Species concerned: C. mydas
E. imbricata

Proclamation No. 37 of 1970, 12 October 1970.
The exportation of unprocessed shell of E. imbricata is prohibited except under the authority of a permit specifying the quantity thereof which may be exported.

The Green Turtles Protection Regulations, 1976, 7 June 1976.
Applies to C. mydas
Females (and parts) are fully protected.
Males may only be taken during the open season (March to October, inclusive) and the sale of their meat is restricted. The possession, sale, purchase or export of the male is prohibited during the close season. A licence is required for slaughtering, the sale of their meat or the possession of more than 2 kg of such meat. The sale, serving or possession of turtle meat by hotels or restaurants is prohibited. Export of this species is completely prohibited except for reared individuals. The Minister is empowered to issue special licences to catch and rear turtles.

The Green Turtles Protection (Amendment) Regulation 1977, 17 July 1977.
It is prohibited to slaughter any turtle or to sell, offer for sale, or expose for sale, any turtle meat, or to have in possession more than 2 kg of turtle meat unless in possession of a butcher's licence. It is prohibited to sell to one person more than 2 kg of turtle meat. The possession of more than 2 kg of salted turtle meat in the Outlying Islands is prohibited.

Hawskbill Turtles (Protection) Regulations, 1977, 12 October 1977.
No person shall purchase, sell or export any preserved or stuffed Hawksbill turtle, or any part thereof, unless authorised by the Minister. Does not apply to the purchase, sale or export of Hawksbill Turtle shells.
[This has since been revoked].

Hawksbill Turtles (Protection)(Amendment) Regulations 1978, 20 October 1978.
Amends the 1977 Regulation to prohibit only the sale, etc. of preserved or stuffed female turtles. It is prohibited to catch, kill, harpoon, or

otherwise take possession of, any female Hawksbill Turtle in the following areas: Aride, Cousin, Cousine, Curieuse and eastern Mahé.

Turtles (Protection) Regulations 1979, 23 November 1979.

The taking or killing of C. mydas and E. imbricata is prohibited in certain areas, except for scientific research. The taking of such turtles on outer islands is also prohibited, except with the consent of the owner of the island. The Minister may authorise the taking and subsequent release of turtles for scientific research and the taking of eggs for rearing purposes.

Trade in and export of preserved or stuffed Hawksbill Turtles, E. imbricata, of either sex or parts thereof is prohibited, unless authorised by the Minister. This prohibition does not apply to turtle shell when detached from the carapace or plastron. The Hawksbill Turtles (Protection) Regulations, 1977, are revoked.

Fisheries Regulations, 31 March 1987, S.I. 35.

No person may catch, kill, disturb or possess a female Green Turtle or female Hawksbill.

Male Green Turtles and Hawksbills may only be caught, killed or sold under permit.

Hawksbill shell may only be sold to local artisans and by permit holders. The permit holder must keep records of all capture of Hawksbills and disposition of the shell.

The possession of unworked Hawksbill shell is prohibited except to permit holders and artisans.

RANCHING

The earliest recorded attempt at turtle ranching was in 1886, when Jules Lauvin constructed tidal ponds on Aldabra for rearing Hawksbills. He intended rearing them for seven years, after which he anticipated obtaining 3-4 lbs (1.4-1.8 kg) of shell from each turtle. His stock had built up to 1230 young animals before his lease was terminated by the Government (Parsons, 1972).

A major ranching operation was undertaken by Mr H. Chenard on Curiuese in 1909, when a 1700-ft (518-m) wall was built to enclose a turtle lagoon of 40 acres (17 ha). This was completed in 1911 and held a stock of 4000 E. imbricata with a staff of eight men. The venture closed in 1915, having suffered from heavy turtle mortality which was attributed to infection, particularly of the eyes (Hornell, 1927). Another scheme was started by the Mahé Syndicate Ltd on St François and Alphonse Islands (Alphonse group) in 1910 with a series of concrete tanks in which the young Hawksbills were reared until they were large enough to turn out into shallow enclosures. Mortality amongst the young turtles ran at about 30% a year until the experiment came to an abrupt end in February 1913 when nearly all of the remaining turtles (around 3000) died simultaneously on both islands (Hornell, 1927).

SIERRA LEONE

Both C. mydas and E. imbricata have been reported to nest; both species at Sussex (source cited in Brongersma, 1982), C. mydas on one of the "Turtle Islands" (source cited in Parsons, 1962), and E. imbricata at Bonthé (Loveridge and Williams, 1957). According to Cansdale (1955), E. imbricata is "common" in Sierra Leone, especially among the Turtle Islands off Sherbro Island. No recent information on nesting, trends or foraging grounds is available.

International trade Sierra Leone is not a Party to CITES. The only record of trade in turtle products recorded in CITES Annual Reports was the import of one shell of C. mydas to the USA in 1981 and seven shells of Cheloniidae in 1984.

LEGISLATION

Wild Animals, Birds & Fish Preservation Ordinance (Amendment) 1948.
A licence is required to export more than two of any species of animal.

POPULATION

While both C. mydas and E. imbricata have been recorded in the waters of neighbouring Malaysia and Indonesia, and both nest on islands in Indonesia's Riau Province (Schulz, 1984), no information is available on their occurrence in Singapore. Turtles would be expected to occur on occasion in Singapore waters, but there appears to be very little nesting habitat available.

International trade Singapore acceded to CITES on 30 November 1986. CITES Annual Reports record the export to Singapore of various turtle products, and these are shown in Table 180. Several countries have reported importing small quantities of turtle products from Singapore, but the only commercial shipments recorded were 400 kg of scales and 200 skins of C. mydas imported by Italy in 1981.

Table 180. Quantities of turtle products reported in CITES Annual Reports to have been exported to Singapore.

Year	Species	Quantity	Exported by
1985	E. imbricata	350 shells	Indonesia
1984	C. mydas	2300 kg shells	Indonesia
		2 kg meat	F.R. Germany
		67 leather items	Italy
1983	C. mydas	12 cans of soup	UK
		68 leather items	Italy
1982	C. mydas	450 shells	Indonesia
		170 kg shells	Tanzania
		176 leather items	Italy
	E. imbricata	32 leather items	Italy
1981	C. mydas	1000 pairs of skins	Indonesia
		581 leather items	Italy
	E. imbricata	110 g shells	Seychelles
1980	C. mydas	109 leather items	Italy
1979	C. mydas	27 kg meat	F.R. Germany

Singapore has long featured as one of the prime entrepots for sea turtle products in the Far East, and the Singapore Customs statistics record the import of raw tortoiseshell and the import and export of worked tortoiseshell (Tables 181 and 182). Some of the material recorded as tortoiseshell may be the shell of freshwater turtles but substantial quantities of sea turtle products are undoubtedly involved as Japan regularly imports bekko from Singapore and Indonesian Hawksbill and Green Turtle products are known to be exported to Singapore. Singapore Customs statistics do not record the import of any product from Indonesia. There is some evidence that the Japanese imports of bekko directly from Indonesia declined in 1986 while those from Singapore increased. This may have been partially due to Singapore's imminent accession to CITES and partially to difficulties in obtaining export permits in Indonesia, causing the shell to be routed via Singapore.

Table 181. Destinations of exports and re-exports of "Tortoiseshell, unworked" 2911620, reported in the Singapore Customs statistics (kg). * = breakdown by countries not available.

	1974	1975	1976	1977	1978	1979*	1980	1981	1982
China	–	–	–	600	–	–	600	538	4743
Hong Kong	30	4760	800	2570	872	–	–	–	–
Japan	367	2522	2688	4416	1456	–	7152	–	13380
Malaysia	10	–	–	–	–	–	–	–	–
Taiwan	4196	13300	13838	19701	43250	–	5190	–	–
Thailand	–	594	–	2080	–	–	–	–	–
Viet Nam	–	10	2700	647	–	–	–	300	–
Other	–	–	–	–	–	–	5090	5538	6315
Total	4603	21186	20026	30014	45578	22983	17897	6376	23438

Table 182. Destinations of exports and re-exports of "worked tortoiseshell and articles thereof" 8911110, reported in Singapore Customs statistics (SG$). * = breakdown by countries not available.

	1975	1976	1977	1978	1979*	1980	1981	1982
Australia	10	0	0	0	–	0	0	0
Brunei	114	0	0	0	–	0	0	0
China	0	0	0	0	–	?	108000	?
France	0	0	193	0	–	?	55000	30000
FR Germany	0	320	0	0	–	0	0	0
Hong Kong	0	560	0	0	–	0	0	0
India	0	0	13	0	–	0	0	0
Italy	0	0	0	350	–	0	0	0
Japan	2920	2440	24295	5016	–	?	58000	47000
Malaysia	570	191	13587	4595	–	0	0	0
Netherlands	0	1150	0	0	–	0	0	0
Reunion	758	0	0	0	–	0	0	0
Taiwan	0	0	0	0	–	?	0	0
UAE	0	0	0	35827	–	0	0	0
UK	0	0	0	252	–	0	0	0
USA	50	180	0	0	–	0	0	0
Others	156	0	0	0	–	0	0	0
Total	4578	4841	38088	46040	158488	536000	231000	130000

LEGISLATION

Wild Animals and Birds Act, Cap 296, 22 October 1965

It is forbidden to kill, take or keep any wild animal or bird other than those specified in the schedule [which does not include any turtles]

without a licence.
Import of any live animal or bird or part thereof is prohibited without written authorisation from the Director [of Primary Production] except for the import of animals or birds in cold storage for use as food where the importer can show that the animal or bird was killed outside Malaysia, Burma, Cambodia, Indonesia, Laos, North Viet Nam, South Viet Nam and Thailand.

POPULATION: Chelonia mydas

Nesting sites Despite the species's abundance throughout the Solomons, nesting areas are relatively few and none supports dense nesting, suggesting that the region is mainly a foraging zone for C. mydas which nest elsewhere (McKeown, 1977; Vaughan, 1981). Most nesting occurs on beaches used also by E. imbricata and Leatherback Dermochelys coriacea. Reported sites include Kerehikapa (in the Arnavon group), Hakelake (Santa Ysabel), islands around Wagina (Choiseul), Ausilala, Maifu and Balaka (Shortlands) (Vaughan, 1981); sparse nesting is likely to be quite widespread in the Solomons.

Nesting numbers Perhaps in part due to the sparsity of C. mydas nesting, most nesting estimates were obtained from coastal villagers, and little beach survey information is available. There are an estimated 15-20 nests a year on Hakelake, around 45 on Kerehikapa, and 10-15 in the Wagina area. The principal C. mydas nesting area appears to be the Shortlands group, where more than 100 nests a year are estimated on Ausilala, around 100 on Maifu, and more than 50 on Balaka (Vaughan, 1981). The Shortlands area is also an important feeding area (Vaughan, 1981). On present information, which is incomplete, it seem likely that the total number nesting annually in the Solomons is in the low hundreds.

Trends in nesting numbers Vaughan (1981) reports his belief that there has been a slight general decline in C. mydas in the Solomons (this applies to the total population, not just nesting numbers); his local informants reported either no decline in numbers or a significant decline. The relatively good condition of C. mydas populations in the Solomons is attributed by Vaughan (1981) to the lack of a commercial trade in C. mydas, to the often low human population, and to the fact that most mydas in the area nest elsewhere, perhaps in Australia, where they enjoy effective protection during nesting.

Nesting season Local informants suggested that C. mydas nest "around Christmas", and 44 of the 56 that nested on Kerehikapa between May 1979 and January 1981 nested between September and March (Vaughan, 1981).

Foraging sites Suitable feeding areas appear to be very widespread in the Solomons. McKeown (1977) notes three areas where large numbers of C. mydas can be found; the Roviana-Marovo lagoon system in west New Georgia, Ontong Java atoll, and the Reef Islands, notably Nupani Atoll. He also reports the species to be "fairly common" in lagoons around north Ysabel and south Choiseul. Vaughan (1981) similarly cites the west New Georgia lagoons (naming Roviana, Marovo, Ndovelle and Vori) as a prime foraging ground; he also highlights the Baolo-Dedou area and Ghoveo, Poro and Thousand Ships Bay (all in Santa Ysabel), and the north side of Wagina.

Migration A female tagged in August 1973 in French Polynesia was recaptured in Malaita (Solomons) in August 1975 (McKeown, 1977); many other turtles tagged while nesting in French Polynesia have been recovered in the Melanesian area (including New Caledonia, Vanuatu and Fiji) (Galenon, 1979) and other such individuals seem likely to enter Solomons waters.

POPULATION: Eretmochelys imbricata

Nesting sites The species is widespread in Solomons waters and significant nesting is known at several sites. Highest numbers appear to use Kerehikapa atoll in the Arnavon group (Santa Ysabel Province), in the

Manning Straits midway between Ysabel and Choiseul (McKeown, 1977; Vaughan, 1981). The Wagina area, notably Haycock and adjacent islands, is also important, and nesting is also known around Santa Ysabel, notably Ramos Island; in the Shortlands, notably islands near Kariki; also New Georgia and Makira.

Nesting numbers There may be 800-950 nests in total in Santa Ysabel Province, with 650-700 of these on Ramos and the Arnavons, comprising 50-100 on Ramos and around 560 on Kerehikapa. The Arnavon group has been cited as the largest known Hawksbill rookery in the Oceanic Pacific (McElroy and Alexander, 1979). Important nesting occurs in the Shortlands, with 400-500 nests annually, half of these on islands near Kariki. Choiseul has some 230-450 nests annually, with nearly 90% (200-400) on Haycock and other islands around Wagina. New Georgia has an estimated 120-175 annually. Fewer than 50 nests occur on Mkira.

These nesting estimates were derived mainly from interviews with local villagers, and in part, particularly in Kerehikapa, from beach surveys. The figures available indicate 1425-1850 _E. imbricata_ clutches are laid annually at the sites specified, with an annual nesting population of perhaps 500 females.

Trends in nesting numbers Although long-term nest survey data are not available, all existing evidence, which is partly anecdotal, indicates a significant decline in numbers in recent years throughout the Solomons (McKeown, 1977; Vaughan 1981). Vaughan (op cit.) summarises the evidence as follows:

1. Shell exports have declined steeply through the 1970s despite an equally steep rise in the price paid to hunters for shell.

2. All turtle hunters interviewed stated that Hawksbills are less plentiful now than formerly.

3. Many nest beaches now appear to support greatly reduced nesting or no nesting; e.g. in the Arnavon group, an estimated maximum of 100 a week nested in peak times within living memory (source in McKeown, 1977); present (c. 1980) nesting is around 560 a year. On Sikopo in 1963, one hunting party took 20 Hawksbills in two nights; in 1974 one hunter took a month to catch 16. An informant on Haycock said that 1-5 Hawksbill nested every night throughout the year in the mid-1960s but in June 1980 not a single turtle nested.

4. At least one major feeding area, previously known as a good hunting site, now holds few turtles.

5. Mean carapace length of females nesting on Kerehikapa has decreased over the late 1970s, possibly indicating over-harvest of larger females.

Nesting season On Kerehikapa, some nesting occurs virtually throughout the year, with a peak in May-August and a lesser peak in November-December (Vaughan, 1981).

Foraging sites Suitable foraging areas would seem to be widespread in the Solomon Islands; Hawksbills appear to be equally widespread, although numbers may be concentrated to some extent along eastern Santa Ysabel, and more so around Wagina, which may be the best _E. imbricata_ feeding ground in the Solomons (Vaughan, 1981)

Migration Two E. imbricata tagged in the Solomons have been recovered elsewhere in the group, having travelled a minimum of 30 and 50 km. Two further tag returns have demonstrated long distance international movements: one female tagged on Kerehikapa on 5 December 1976 was killed in February 1976 at Fisherman's Island in Papua New Guinea (Central Province), having covered 1400 km; a second female tagged on 31 March 1979 at Sakeman's Reef in Australia (Torres Straits) nested on Kerehikapa on 16 February 1980, having travelled 3600 km (Vaughan, 1981). Vaughan believes that not all the E. imbricata nesting in Kerehikapa are resident in the immediate vicinity; the two international tag returns suggest that at least some of the Hawksbills nesting in the Solomons migrate to nest from foraging grounds in the Australia-Papua New Guinea region.

EXPLOITATION

Commodity All species of turtle are exploited for their meat and eggs on the Solomon Islands. C. mydas is the favourite for meat, but many people relish E. imbricata. Turtles are occasionally consumed at ceremonial feasts, particularly Christmas and Easter, and are often hunted for this purpose. There are several recorded cases of turtle poisoning; in most, the species was not known but in one case E. imbricata was implicated and in others D. coriacea was the suggested cause. Most of the locals questioned had never heard of turtle poisoning. Hawksbills are said to be seldom hunted specifically for meat, and most are hunted primarily for the sale of shell. About 10% of the population are Seventh Day Adventists, who refrain from eating turtles for religious reasons (Vaughan, 1981).

Hunting intensity The rate of egg collection is said to be high, and eggs of all species are always taken if they can be found. Most beaches are said to be regularly visited even if they are not permanently inhabited, and 67% of the 76 nesting beaches visited were classified as having "high" human usage. In Wagina, some nests are occasionally left to hatch unmolested, and those which are found to be too far developed are often reburied. Green Turtles are thought to have suffered less than Hawksbills from egg collection because they tend to nest on more remote beaches (Vaughan, 1981).

The level of subsistence hunting for C. mydas is not known, but interested hunters are said to catch them throughout the year. At Furona, Santa Ysabel, 49 were caught for a feast at Christmas 1980. Most of the Hawksbill shell for export derives from the Manning Strait and surrounding areas (Vaughan, 1981).

Hunting methods Eggs are located mainly by reading the tracks on the sand, but occasionally sticks are used for probing. Once a nest has been located, the eggs may be aged to calculate the probable time of re-emergenge of the female, from a knowledge of the inter-nesting interval. Days are counted by tying knots in a piece of rope so that the hunters know when to await the female's return. Turtles are also caught at sea. The most popular methods are spears and specialised, large-mesh turtle nets, which are often set at night. Canoes and outboards are increasingly being used to locate and spear turtles. A technique of diving for turtles is becoming popular in the west of the islands, where it is believed to have been introduced by the immigrant Gilbert Islanders (Vaughan, 1981).

Historical trends There is no direct information on the past levels of turtle exploitation, but the subsistence use of C. mydas is almost certainly related to the human population which is growing at 3.4% a year. There has

also been a tendency for people to move from the interior to the coast, because of ease of transport and, once there, to rely more on marine produce for food (Vaughan, 1981).

Hawksbill hunting has undoubtedly intensified as a result of the commercial demand for shell, and there is evidence of local population declines, for example on Sikopo, in the Arnavon Islands (see under "trends in nesting numbers"). On Wagina, several families used to rely solely on turtle hunting for their income, but they have had to turn to supplementary sources of income, in spite of the higher price for shell, partially because of declines in turtle abundance (Vaughan, 1981). Statistics on the amount of Hawksbill shell sold by two local co-operatives in Wagina, compiled by McKeown (1977) and Vaughan (1981) are given in Table 183, and both indicate that the volume of trade has declined.

Table 183. Quantities of turtle shell (kg) sold by two co-operatives in Wagina, compiled by McKeown (1977) and Vaughan (1981). * indicates that estimates were made for the whole year by scaling up data for part of the year (>5 months).

	1972	1973	1974	1975	1976	1977	1978	1979	1980
Oronoa	-	-	-	-	298	175	241	139	55 *
Nikumarore	436	258	288	152	91	172 *	-	233 *	200 *

Domestic trade Almost all of the hunting of Green Turtles is for local consumption of meat on a subsistence basis. The meat and eggs are very rarely sold, but may be seen in Gizo, where a cooked turtle will bring up to SI$35 (Vaughan, 1981). The shells are occasionally sold to traders, but they fetch such low prices that the transport to Honiara is usually prohibitive, and they are usually thrown away (McKeown, 1977). The primary incentive for hunting Hawksbills is the sale of shell; some hunters do not eat the meat, hunting only for shell, but an increasing number of meat hunters are catching Hawksbills because they can obtain a subsidiary income from the shell. Most of the shell is sold to the village store or local co-op, which then sells it on to the exporting traders, although there is some direct dealing between traders and hunters. The price of shell in the villages is said to have increased from SI$0.90 in 1972 to SI$7.00 in 1980 (Vaughan (1981) implied that this was the price per kg, but McKeown (1977), from whom he derived the earlier figures, indicated that it was the price per pound).

International trade Almost all of the Hawksbill shell caught is destined for export, mostly to Japan (Vaughan, 1981). Japanese Customs statistics (Table 184) only report the import of "bekko" from the Solomon Islands, indicating that all the shell is of E. imbricata. The volume of imports in 1986 was the highest since 1973, possibly indicating that Japanese dealers have been turning to the Solomon Islands as imports from CITES Parties have been curtailed in recent years.

The Statistics Office (Honiara) compiles estimates of the total quantity of turtle shell exported from the Solomon Islands. These show that exports amounted to 1133 kg in 1984, 1598 kg in 1985 and 568 kg in the first quarter of 1986. These show remarkably high correlation with the Japanese import statistics.

SOLOMON ISLANDS

There is a small tortoiseshell-carving industry in the islands, the products being sold to tourists and occasionally exported to neighbouring Pacific islands (Vaughan, 1981).

The Solomon Islands are not a Party to CITES, but the CITES Annual Reports contain importers' reports of two transactions in shell of Cheloniidae from the islands. In 1983, the USA imported four carvings from Switzerland, which originated in the Solomon Islands; and in 1982, Australia reported importing one shell directly from the islands.

Table 184. Imports of bekko (kg) from the Solomon Islands reported in Japanese Customs Statistics.

1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1590	378	657	846	873	756	528	924	704	336	1206	992	1127	1556	1793

RANCHING

No commercial ranches have been started in the Solomon Islands, but a headstarting project was run in the Arnavon Sanctuary. In 1977, 1000 hatchlings were kept in galvanised tanks for five months, after which only 284 survived. These were transferred to a coral pond at Wagina, where they were fed by villagers for a year (McKeown, 1977). The project foundered when it became involved in a land dispute in the early 1980s. Armed islanders claimed ownership, destroyed the buildings and forced the staff to leave (T. Daly pers. comm., 1988).

LEGISLATION

Fisheries Regulations 1972.

It is prohibited to export, or attempt to export, the shell of any turtle of less than 60 cm in carapace length.

The taking of _D. coriacea_ is completely prohibited without a permit granted by the Principal Fisheries Officer.

Fisheries (Amendment) Regulations 1977.

It is prohibited to sell or expose for sale any turtle with a carapace length of less than 75 cm.

Prohibited to take, destroy, possess, sell or expose for sale, buy or export eggs of _D. coriacea_ except under a written permit.

POPULATION: Chelonia mydas

Nesting sites Although the Somali coast is reputed to hold very large numbers of C. mydas, and major nesting has been reported to occur, little detailed information is available. According to Ninni (1937, cited in Frazier, 1982), the species nests along much of the Indian Ocean coast of Somalia. Cozzolino (1938) reported his behavioural observations made on C. mydas nesting on a small islet in southern-most Somalia, presumbly one of the Bajun group. Travis (1967), who provided much of the available information on turtles in Somalia, reported nesting north of El Afuen (midway between Brava and Merca), and at Gandersheikh (between Merca and Mogadiscio). While these are the only sites specifically noted as nesting areas by Travis (1967), he stresses that very large numbers of turtles occur widely along the nearly 500 km of coast between Kismayo and Mogadiscio, and implies that nesting is very widespread on the extensive and poorly-accessible beaches of this region (the Benadir Coast). However, Robertson (in litt., 10 June 1987) pointed out that from Mogadiscio to Kismayo much of the coast is fronted by cliffs, and that although there are some sandy bays they are often close to fishing camps and therefore very vulnerable to disturbance. The same applies to long sections of the coast north of Obbia. Travis also implies that significant numbers nest around the Horn of Africa, including the southern coast of the Gulf of Aden; however, no localities are cited. Recent sources (J. Nimmo via L. Barratt in litt., 16 April 1987) confirm that "hundreds" of turtles can be seen at sea off the north coast of Somalia, and turtle tracks have been seen on the northern beaches (although the species is unknown, C. mydas is most likely).

Nesting numbers Travis (1967) described nesting numbers at two areas between Kismayo and Mogadiscio as "huge" and "immense", with nest pits "everywhere" and tracks of nesting females covering the sand. Although no numerical estimates are available, the implication is that very heavy nesting occurred in the region at the time of Travis's operations (apparently c. 1963-1964). If Travis's information is reliable and Robertson (in litt., 10 June 1987) cautioned that it may be exaggerated, it is possible that several thousand C. mydas nested annually in Somalia in the early 1960s. Fagotto (in litt., 29 August 1986) considered the species to be abundant in Somalia in the 1970s, and Elder's estimate (Anon., 1986d) of an annual catch of 3500-4000 C. mydas is indicative of a large population.

Trends in nesting numbers No long-term, quantitative survey data are available; however, Fagotto (in litt., 29 August 1986) has compared his observations in 1984 with field notes from 1968-1971. At all five coastal sites recorded, from Kismayo to Uarsciek (80 km north of Mogadiscio), fewer turtles were seen per visit in 1984 than in 1968-1971. These findings are suggestive of a decline in numbers. Over the same period, the mean size of turtles appears to have decreased; whereas large adults, 1 m or more in carapace length, were common in 1968-1971, only one 1 m animal was encountered in 1984 (at Gezira) (F. Fagotto, in litt., 29 August 1986). Simonetta and Magnoni (1986) also report that marine turtle stocks have been "dramatically depleted all along the Somali coast, wherever there are substantial human settlements". They estimate that numbers south of Adale (about 150 km north of Mogadiscio) have declined by about 90%, and that perhaps half of the former nesting sites have been abandoned (the evidence for this decline is not presented).

Nesting season No detailed information is available; Travis (1967) implies that some nesting goes on virtually throughout the year, but, in the

south at least, declines at the start of the rainy season (the main rainy season is March-May).

Foraging sites According to Travis (1967), prime C. mydas foraging grounds extend for almost the entire southern coast of Somalia, from near Mogadiscio south to the border with Kenya. In this region, a fringing reef occurs close off shore, with an extensive zone of shallows and seagrass pastures enclosed between it and the coastal dunes. No information is available for other parts of the country, although good numbers of turtles were reported around Alula on the Gulf of Aden coast, perhaps indicating the existence of good foraging sites. As noted above, recent information is that turtles are seen in abundance off the north coast of Somalia (J. Nimmo, via L. Barratt, in litt., 16 April 1987).

Migration It is unknown whether all or some of the C. mydas nesting in Somalia are permanently resident in the country, or migrate to feeding grounds elsewhere. It is clear, however, that Somalia provides foraging sites for the C. mydas population nesting in South Yemen, five turtles tagged in the latter having been recovered in Somalia (two at Hordio, two at Mogadiscio, one at Kismayo) (Hirth and Carr, 1970).

POPULATION: Eretmochelys imbricata

Very little information is available. Travis (1967) records the presence of E. imbricata among the northern Bajun islands, in southern-most Somalia. Fagotto (in litt., 29 August 1986) reports that the species was not abundant in Somalia at the time of his first visit, in 1968, nor since; it was highly sought after for shell, used in local tortoiseshell industries.

EXPLOITATION

Commodity C. mydas is the principal species hunted for meat for local consumption, although E. imbricata is also eaten. Travis (1967) reported that, being Moslem, most of the Somalis except the Barjuni did not eat turtle, although they will eat turtle eggs. This view was echoed by Fagotto (in litt., 29 August 1986), who said that most of the demand in 1984 was from restaurants and Europeans. Eggs are also collected and eaten. There is a good demand for Hawksbill shell for export and for the manufacture of curios for tourists. Polished carapaces of both C. mydas and E. imbricata are also sold (Simonetta and Magnoni, 1986; Anon., 1986d; Elder, pers. comm.). There was formerly an export trade in calipee, oil and leather (Travis, 1967).

Hunting intensity Elder (Anon., 1986d) estimated that between Kismayo and Ras Chiaboni there were about 400 fishermen all catching an average of 3-4 turtles a week during the peak six months. A further 400 fishermen were said to be operating between Merca and Kismayo. The total catch of C. mydas was said to be about 3500-4000 a year. Robertson (in litt., 10 June 1987) considered that this estimate was probably excessive, pointing out that domestic demand was low and that the German-run factory at Kismayo was the only processing plant capable of producing meat of export quality. Eggs are also collected, certainly around Gezira, but possibly also elsewhere (Simonetta and Magnoni, 1986).

Hunting methods Travis (1967) described the use of large-mesh turtle nets which were set across channels in the reef. A boat crew of three could

work five 20-m nets. Remoras were also used by the Barjunis for catching turtles. Usually, they attached themselves to a turtle sleeping on the sea bed, whereupon a diver would follow down the line to attach a noose of heavy rope to the turtle's flippers. Alternatively, if the turtle was too deep, a special type of grapnel or "turtle iron" would be lowered down the remora's tethering line to hook the turtle. Each remora could be used to catch about 40 turtles before it tired "of this un-natural life". Turtles are also killed on the nesting beaches by fishermen who camp there for this purpose (Simonetta and Magnoni, 1986). Goodwin (1971) related that during Travis's work, 79% of the turtles were caught in nets, 14% by remoras, 4% by turning on the beach and 3% by other means. Travis (1967) provided a description of how scutes were removed from Hawksbill carapaces by burying them in sand for two or three weeks.

Historical trends Travis (1967) was involved in the management of a turtle fishery operating off the southern coast of Somalia to supply a canning factory at Kismayo around 1963-1964. The operation only had a licence to operate in the southern half of the country and Travis implied that there was little turtle exploitation to the north of Mogadisho. During one year, a total of 8436 C. mydas were caught along 400 km of coast between Bur Gavo and Merca; 62% of the turtles were males. In the Barjun Islands alone, 3800 turtles were said to have been caught in one year (Goodwin, 1971). Travis reported that he had to persuade the fishermen to increase substantially their rate of harvesting turtles to keep the canning factory supplied. Previously, he implied that the local Barjuns had only fished for subsistence purposes, as most of the other Somalis were Moslem and did not eat turtles. Around 1975/76, the Barjuni Islanders were compulsorily relocated to the mainland at Kulmis. Although some return, the hunting pressure has probably declined. At that time there was said to be little demand for Hawksbill shell, although Travis (1967) reported that a few were killed for this purpose. He said that the value of a set of Hawksbill shell, weighing about 5 lbs (2 kg) was worth about £1.50, whereas "formerly ten times this figure for a similar set was usual".

An FAO fishery consultant (I.I.B. Robertson in litt. to J. Frazier, 26 January 1978) in Somalia reported that it was believed that there was little exploitation of turtles for foreign markets since Travis had ceased his activities. However, CITES Annual Reports (see below) record the import of 18.6 t of turtle meat to F.R. Germany in 1977 from Somalia, and Frazier (in litt. to F. Compton, 1 December 1977) reported that there had been "repeated efforts to import Green Turtle to the United Kingdom". Robertson (in litt., 10 June 1987) indicated that France had been declaring Somalia as the country of origin for imports of turtle meat around the same time.

Fagotto (in litt., 29 August 1986) reported that there was a much greater demand for turtle meat in restaurants in 1984 than there had been in 1970, and that the number of polished carapaces on sale in tourist shops had similarly increased.

Domestic trade About 15-20 tourist shops in Mogadishu were said to be selling polished carapaces in 1984. An offer of 500 Somali shillings for a live turtle about a metre long was turned down as being inadequate (F. Fagotto, in litt., 29 August 1986). Most of the carapaces sold are small, usually less than 60 cm; the larger ones (c. 1 m) are not popular. There is said to be a well-established cottage industry producing decorated carapaces in Lower Juba, centred on Kismayo (I.I.B. Robertson in litt., 10 June 1988).

International trade In addition to the turtle products exported from Kismayo by Travis's operation, described above, substantial numbers were caught in the Barjuni Islands off the Somali coast and transported to Mombasa, Kenya, whence they were exported to Europe. From 1954 to 1959, 1000-1500 live turtles a year were exported from Kenya, an unknown proportion of which derived from Somalia. The Barjuni fishermen were said to be supplying most of the frozen carcasses and live turtles imported to England (Parsons, 1962).

Somalia acceded to CITES on 2 March 1986. Apart from the 18.6 t of meat imported to F.R. Germany in 1977, mentioned above, and scattered reports of the import of single turtle shells to Denmark, the Netherlands, and the USA, most of the trade in turtle products from Somalia recorded in CITES Annual Reports has involved Italy. Between 1980 and 1983, Italy reported importing 250 shells of C. mydas from Somalia, and exporting 24 handbags made from the leather of C. mydas originating in Somalia.

Japanese Customs statistics have recorded the import of both bekko and other tortoiseshell from Somalia. The quantities are shown in Table 113.

Table 113. Imports of bekko and other tortoiseshell from Somalia reported in Japanese Customs statistics (kg). No imports were recorded 1950-1968 or 1977-1986.

	1969	1970	1971	1972	1973	1974	1975	1976
Bekko	0	0	0	75	395	320	100	873
Other T'shell	467	0	0	600	0	0	0	0

LEGISLATION

While on land, turtles fall under the jurisdiction of the National Range Agency, but at sea they are the concern of the Ministry of Fisheries. Up until 1986, the export of turtle shell, but not of oil, required a licence (Simonetta and Magnoni, 1986).

Both C. mydas and E. imbricata have been recorded in South African waters; neither species has been known to nest in the country, and exploitation appears to be minimal (Hughes, 1974 and 1982b).

EXPLOITATION

International trade Although there is no evidence of exploitation of indigenous populations of C. mydas or E. imbricata, CITES Annual Reports indicate that considerable quantities of leather and edible products of C. mydas have been exported to South Africa. These are shown in Table 186. It is of interest that none of these transactions has been recorded in the South African Annual Reports.

LEGISLATION

Ordinance 15, Section 101, 1974
All species of sea turtle are protected. They may not be killed, molested or traded.

Table 186. All trade in C. mydas, E. imbricata or unspecified sea turtle products involving South Africa recorded in CITES Annual Reports since 1976. The country underlined is the one which submitted the report.

	Exporter	Importer	Origin	Commodity	Purpose
1985 C. mydas					
	UK	S. Africa	Cayman I.	50 cartons soup	
1984 C. mydas					
	FR Germany	S. Africa	Nicaragua	2 kg meat	Commercial
	UK	S. Africa	Cayman I.	10 cartons soup	
	Italy	S. Africa	Cayman I.	8 handbags	
1983 C. mydas					
	Canada	UK	S. Africa	3 shells	Personal
	FR Germany	S. Africa	Cayman I.	1 kg soup	Commercial
	UK	S. Africa	Cayman I.	3500 cans soup	Commercial
	Italy	S. Africa	Cayman I.	24 pairs of shoes	Commercial
	Italy	S. Africa	Cayman I.	175 skins	Commercial
	Italy	S. Africa	Cayman I.	8 leather items	Commercial
1982 C. mydas					
	UK	S. Africa		1 carving	Commercial
	Italy	S. Africa	Ecuador	84 pairs of shoes	
	Italy	S. Africa	Ecuador	200 skins	
	Italy	S. Africa	Cayman I.	11 handbags	
	Cayman I.	S. Africa		16 carvings	Commercial
	Cayman I.	S. Africa		4 pieces leather	Commercial
	Cayman I.	S. Africa		125 shells	Commercial
	S. Africa	USA		1 shell	Illegal
1981 C. mydas					
	DE	S. Africa	Costa Rica	191 skins	Commercial
	Italy	S. Africa	Colombia	7 handbags	

Table 186 continued

	Exporter	Importer	Origin	Commodity	Purpose
	Italy	S. Africa	Ecuador	350 skins	
	Italy	S. Africa	Honduras	36 handbags	
	Italy	S. Africa	Honduras	2 skins	
	Italy	S. Africa	Mexico	74 handbags	
	Italy	S. Africa	Mexico	175 skins	
1980 C. mydas					
	FR Germany	S. Africa	Cayman I.	27 kg meat	
	Italy	S. Africa	Mexico	462 skins	
	Italy	S. Africa	[XX]	2 handbags	
	Italy	S. Africa	[XX]	236 skins	
	Cayman I.	S. Africa		4100 lbs meat	Commercial
1979 C. mydas					
	Italy	S. Africa	Ecuador	171 pairs of shoes	
	Italy	S. Africa	Honduras	50 skins	
	Italy	S. Africa	Honduras	3 wallets	
	Italy	S. Africa		584 skins	
	Italy	S. Africa		5 skin/leather items	
1978 E. imbricata					
	Seychelles	S. Africa		2 bodies	
	S. Africa	Switzerland		1 body	Personal
1982 E. imbricata					
	S. Africa	Canada		3 carvings	
1978 Cheloniidae					
	Italy	S. Africa	Mexico	70 pairs of shoes	

POPULATION: **Chelonia mydas**

Nesting sites Some sources (eg. Deraniyagala, 1939) suggest that nesting in Sri Lanka is extremely sparse; more recent information (Wickremasinghe, 1981, 1982; Dattatri and Samarajiva, 1983) is that the species does nest at several sites. The main sites are Batticalao and Kalmunai in the east; Yala National Park, Bundala Sanctuary and Hambantota, in the south-east; and Kosgoda in the south-west (Dattatri and Samarajiva, 1983).

Nesting numbers Few numerical data are available. At the 3 km Kosgoda beach, one of the three main Sri Lankan nest sites for this species (and probably the island's single most important turtle beach), 12 C. mydas were seen ashore in one night (Dattatri and Samarajiva, 1983). Only Yala N.P. and Bundala Sanctuary are likely to be comparable. No estimates of total annual nesting or of seasonal female numbers are available. Overall, the species is considered uncommon in Sri Lanka (Dattatri and Samarajiva, 1983)

Trends in nesting numbers No quantitative data are available, but according to Dattatri and Samarajiva (1983) the species is declining rapidly due to exploitation and disturbance (it is not clear whether this statement refers to nesting numbers in particular, or to nesting and feeding population in general).

Nesting season Some nesting (at Kosgoda, in the south-west) occurs throughout the year but with a peak in April-May (i.e. just before the south-west Monsoon during May-September) (Dattatri and Samarajiva, 1983).

Foraging sites Little recent or detailed information is available. Deraniyagala (1939) considered C. mydas to be very common in Sri Lankan waters, particularly in the larger gulfs and lagoons; Puttalam lagoon (west coast) and Tamblegam lagoon (east) were cited as examples. The species is said to be relatively common over the extensive seagrass beds in the Gulf of Manaar (Salm, 1981)

POPULATION: **Eretmochelys imbricata**

Nesting sites Sparse nesting appears to occur at several places around the island, wherever suitable habitat is present, but there is no evidence at present to suggest that any site holds other than small numbers. According to Dattatri and Samarajiva (1983) the main nesting areas are Batticalao and Kalmunai in the east; Yala National Park, Bundala Sanctuary and Hambantota in the south-east; and Kosgoda in the south-west; also on the south coast.

Nesting numbers No numerical data are available. Overall, the species is considered uncommon in Sri Lanka (Dattatri and Samarajiva, 1983).

Trends in nesting numbers Little quantitative information is available; however, Deraniyagala (1939) states that numbers were greatly depleted at his time of writing, although the species had been so abundant off the southern coast (eg. Palutupana and Amaidhuva) in the mid-19th century that the Government leased the right to harvest E. imbricata for its scutes. Dattatri and Samarajiva (1983) believe that the species is uncommon and probably declining.

Nesting season Deraniyagala (1939) suggests that peak nesting varies in different parts of the island: primarily in November-February on western

coasts, while the north-east monsoon is blowing; in April-June on eastern coasts, during the south-west monsoon. Peak nesting at Kosgoda (in the south-west) occurs in December-January, according to Dattatri and Samarajiva (1983).

Foraging sites Dattatri and Samarajiva (1983) state that E. imbricata occurs around the entire island; as with mainland India (Kar and Bhaskar, 1982) the species may be concentrated in the Gulf of Mannar and Palk Straits area.

EXPLOITATION

Commodity Turtles are exploited for meat, eggs and shell in Sri Lanka. Although the meat of all five species present is consumed, C. mydas is the preferred species. The majority of Sri Lankans are Sinhalese Buddhists, who eat neither turtles nor their eggs, however most of the fishermen belong to two minority groups, the Sinhalese Christians and the Tamils, both of whom consider turtles to be delicacies. Tamil Muslims, who mainly live in the south-eastern area, do not eat turtles, but may consume eggs (Dattatri and Samarajiva, 1983). Turtle flesh is a ceremonial dish for Christians in Jaffna and is used on Sundays and Roman Catholic festivals (Salm, 1981). The meat of E. imbricata is not generally eaten except by a few poor fishermen, there being several recorded instances of poisoning (Deraniyagala, 1939), but it is exploited for its shell.

Hunting intensity The current levels of turtle exploitation are not known, but fishing and trade, although illegal, are said to flourish clandestinely (Dattatri and Samarajiva, 1983; Steuer, 1986). Frazier (1980) speculated that the total catch may be in the region of 3000-5000 turtles [of all species?] annually. Long stretches of nylon nets, set to catch sharks, rays and squid, form a virtually impenetrable barrier which catches many turtles. One fisherman reported catching 16 adult turtles in a single net. The main fishing areas are concentrated on the west and south coasts, with a few fishing centres also in the north-east (Dattatri and Samarajiva, 1983). Most of the fishery is in the Gulf of Manna which is also subject to heavy exploitation from the Indian coast (q.v.).

Eggs are collected all around the coast, and Dattatri and Samarajiva (1983) estimated that, at least in densely populated areas, 100% of the eggs were collected.

Hunting methods Jaffna is one of the main centres for turtle fishing, and has been for many generations, the principal method being to use set nets. Harpooning and capturing females on the nesting beaches are also practised to a lesser extent (Deraniyagala, 1939; Frazier, 1980a). Formerly, the turtles used to be kept in holding ponds and slaughtered together, usually on Sundays. Since turtle fishing has been made illegal, the turtles are caught and slaughtered clandestinely, usually on the beach in the small fishing villages when the boats come in in the early mornings. Egg collection is normally carried out on an opportunistic basis by village children, who sell them for pocket money (Dattatri and Samarajiva, 1983).

The fishery for E. imbricata used to be highly organised before the species became so scarce. Sometimes the Hawksbills were killed but, more often, the scutes were removed from the living animal by holding it over hot embers, after which it was released (Deraniyagala, 1939). This practice is still carried on in a few places (Dattatri, 1982).

Historical trends Turtle exploitation has a long history in Sri Lanka, which has featured as an entrepot for Arab, Indian, Chinese, and Javanese traders since earliest times (Parsons, 1972). Sinhalese Kings used to present gifts of tortoiseshell to foreign courts before the Christian era. At one time, Hawksbills were so abundant in parts of the south coast that the Government sold the rights to capture them to private individuals. This was carried out from at least 1797-1843, but the population had evidently declined before the first half of this century (Deraniyagala, 1939).

The fishery for other species of turtle for meat (mostly C. mydas and L. olivacea) flourished for longer and, prior to 1972 when it was made illegal, several thousand turtles were thought to be caught annually (Dattatri and Samarajiva, 1983). Salm (1981) estimated that in 1975, 50 000 people were still dependent on turtle fishing for subsistence, and said that the authorities turned a blind eye to the activity because of socio-economic pressures. Frazier (1980) cited figures apparently collected in 1975 and 1977 which indicated that about 1500 turtles a year were still being landed in Jaffna, and concluded that the annual catch for the whole country was probably in the region of 3000-5000. The Wildlife Conservation Department issued a directive to its officers in 1976 to step up turtle protection measures, and most rural people are said now to be aware of the regulations, although they still carry on the illegal trade underground (Dattatri and Samarajiva, 1983).

Domestic trade The main centres for turtle meat trade are Jaffna and, on the south coast, Alutgama, Dodanduwa, Boosa, Ratugama, Galle, Mirissa, Matara and Tangalla (Dattatri, 1982). Meat is said to sell mostly for Rs4-10 a lb (US$0.44-1.10 a kg), although a figure of Rs50 a lb (US$5.5 a kg) was quoted for the northern coastal zone. Eggs cost Rs0.25-Rs1.5 (US$0.01-0.08) each (Dattatri and Samarajiva, 1983).

The value of Hawksbill shell is well appreciated, and it is mostly sold to a class of Tamil businessmen, known as Nadars, or to local jewellers. The scutes from a single turtle are worth Rs250-300 (US$12-15) (Dattatri and Samarajiva, 1983). Turtle shell products are said to be sold in large numbers in curio shops around the island, even in the mountains (T.G. Hughes in litt. to S. Wells, 1985). There is a long tradition of working in tortoiseshell, and the local artisans are said to be some of the finest in the world (Frazier, 1980a).

International trade Sri Lanka has long featured in the international trade routes for tortoiseshell. Once the local stocks of E. imbricata

Table 187. Imports and exports of Eretmochelys scutes from Ceylon (kg).

	Imports	Exports
1920	163	864
1921	873	467
1922	2293	341
1923	2211	341
1924	2020	255
1925	1959	341
1926	1518	358

became depleted, the artisans turned to the Maldives for a supply of raw material (Frazier, 1980a). Deraniyagala (1939) quoted Customs figures showing imports and exports 1920-1926 (Table 187).

In recent years, Sri Lanka does not seem to have indulged in much international trade in tortoiseshell. The last year in which exports were recorded in Sri Lankan Customs statitistics was 1976, when 2 kg were reported to have been exported to Australia. In the same year Singapore Customs statistics recorded an import of 16 kg from Sri Lanka. Japanese Customs statistics do not indicate that Sri Lanka has been a major supplier of shell. Japan's only imports of bekko (shell of E. imbricata) from this source were 46 kg in 1980 and 17 kg in 1983; a further 150 kg of "other tortoiseshell" was imported from Sri Lanka in 1979.

CITES Annual Reports only contain a single reference to trade in sea turtle products with Sri Lanka when the USA reported importing five C. mydas in 1981.

LEGISLATION

Fauna and Flora Protection Ordinance, 1 March 1938. Amended 20 July 1972.

The importation, without a permit, of live reptiles belonging to non-indigenous species is prohibited. The exportation, without a permit, on indigenous reptiles, dead or alive, or of their eggs, skins or any other parts is also prohibited. the following species are totally protected. It is an offence to capture, kill, injure or possess these animals or their eggs:

C. caretta gigas
C. mydas
E. imbricata
L. olivacea olivacea
D. coriacea

RANCHING/HATCHERIES

There are no commercial turtle ranches in Sri Lanka, but several conservation-orientated hatcheries have been established. The Wildlife and Nature Protection Society has supported the establishment of hatcheries, and first suggested the idea in 1962; however it was not until 1970 that the first hatchery, at Palatupana, came into being (Wickremasinghe, 1981). Since then, a further two have begun operations under WNPS guidance and two more run by the Wildlife Department.

Palatupana Turtle Hatchery, situated in a remote region just outside Yala National Park, was established in 1970 in the grounds of the WPNS bungalow. Eggs are bought by the bungalow keeper from the local coastal people and are reburied in the a walled-off area. Hatchlings are kept in brine-filled containers and are released at the earliest opportunity. The species of turtles released has not been recorded, but the numbers are given in Table 188 (Wickremasinghe, 1981 and 1982).

Bentota Beach Hatchery, located behind the Bentota Beach Hotel, started operations in 1972 and apparently functioned intermittently until 1981, when it received an injection of interest and funds from WNPS and the Hasselblad Trust (Wickremasinghe, 1981 and 1982). It buys eggs from residents, who collect them from the beaches between Kosgoda and Bentota, since the turtles

have ceased to nest on the beach behind the hotel (Dattatri and Samarajiva, 1983). The numbers of eggs collected and hatchlings produced is given in Table 189.

Table 188. Numbers of eggs collected and hatchlings released at Palatupana Turtle Hatchery (Wickremasinghe, 1981 and 1982).

	1970-81	1981/82
Eggs buried	20279	4372
Hatchlings released	13443	2341
Hatching percentage	66%	55%

Table 189. Numbers of eggs collected and hatchlings released at Bentota Beach and Kosgoda Turtle Hatcheries (Wickremasinghe, 1981 and 1982).

	Bentota		Kosgoda
	1977/78	1981/82	1981/82
Eggs buried	1257	9831	33741
Hatchlings released	870	4868	5219
Hatching percentage	69%	68%	21%
Species released			
C. mydas		86	987
E. imbricata		310	205
L. olivacea		4122	3565
D. coriacea		275	249
C. caretta		75	213

Kosgoda Hatchery was established in 1981 by the WNPS near the mouth of the Duwa River. The eggs are purchased from collectors along the coast from Induruwa to Balapitiya, some are collected by hatchery staff, and some confiscated eggs are received from the police. The price paid is above market rates to divert eggs from the food market. In 1986, the price was 40-50 cents an egg (Wijesekera, 1987). The eggs are buried in two sand enclosures, raised slightly above ground level, and the hatchlings are kept in a cement tank until they are ready to be released (Wickremasinghe, 1982). One report sugested that this could be up to two months (T.G. Hughes _in litt._ to S. Wells, 1985) but three days is more usual (Wijesekera, 1987). The numbers of hatchlings released are given in Table 189. The reason for the low hatching percentage was not known, but might be due to the fact that the egg pits are above ground level (Wickremasinghe, 1982). The hatchery was still functioning in 1987 (Wijesekera, 1987), having had to rebuild some of its facilities after severe storm damage (T.G. Hughes _in litt._ to S. Wells, 1985).

Two further hatcheries have been established within national parks at Yala and Bundala, and are operated by the Wildlife Department (Dattatri and Samarajiva, 1983).

POPULATION: Chelonia mydas

Nesting sites Wilkins and Meylan (1984) reported nesting on St Kitts at Sandy Point, Newton, Dieppe Bay, Sandy Bay, Conaree, Sand Bank Bay, Majors Bay, North Friar's Bay, Garvey's, Challenger's, Mosquito Bay and Cockleshell Bay. Nesting was also noted at Banana Bay and Belle Tête (Meylan, 1983). Nesting on Nevis was reported at Pinney's Beach, Red Cliff and Indian Castle (Wilkins and Meylan, 1983).

Nesting numbers Meylan (1983) considered Green Turtle nesting on St Kitts to be sporadic.

Trends in nesting numbers Towle (1986) considered that sea turtle populations had begun to decline several hundred years ago and, according to Meylan (1983), most residents on St Kitts believed sea turtle populations to be declining. These reports do not necessarily include nesting turtle populations.

Nesting season Nesting observed by Wilkins and Meylan (1984) occurred mainly from March/May to September/October.

Foraging sites Wilkins and Meylan (1984) reported foraging at Sandy Point, Willet's/St Paul's, Dieppe Bay, South Frigate Bay, and Majors Bay at St Kitts; and at Pinney's Beach on Nevis. Meylan (1983) noted Green Turtle foraging, occasionally in groups, on the north coast and south-eastern peninsula on St Kitts, and widespread foraging around Nevis.

Migration Meylan (1983) noted the capture, at Nevis, of several Green Turtles that had been tagged at Aves Island, and suggested that Nevis may be one of the resident feeding grounds for that population.

POPULATION: Eretmochelys imbricata

Nesting sites Wilkins and Meylan (1984) reported nesting on the same beaches as those on which Green Turtles nested, with the addition of two sites on Nevis, at Hurricane Hill and New Castle. Meylan (1983) reported nesting at Banana Bay and Belle Tête on St Kitts.

Nesting numbers Meylan (1983) considered Hawksbill nesting on St Kitts to be sporadic and noted very small numbers nesting at Indian Castle and Red Cliff, probably the only localities on Nevis that were still regularly used for nesting.

Trends in nesting numbers See above account of trends in Green Turtle nesting numbers. Meylan (1983) considered that there may have been a decline in the Hawksbill population of Nevis.

Nesting season Nesting recorded by Wilkins and Meylan (1984) occurred during the same months as that of the Green Turtle.

Foraging sites Wilkins and Meylan (1984) reported foraging at Sandy Point, Willet's/St Paul's, Dieppe Bay, Key's/Conaree, South Frigate Bay, Major's Bay, and Pinney's Beach. Hawksbills also foraged at Belle Tête and Canada Estate on St Kitts, and in the Black Bay area on Nevis.

THREATS

According to Towle (1986), the primary threat to the survival of sea turtles on the south-east peninsula of St Kitts was direct exploitation. He also noted that local residents had been seen herding pigs on to the beach to feed on eggs, and observed that similar activities occurred elsewhere on St Kitts.

EXPLOITATION

Commodity St Kitts: Meylan (1983) noted that the meat of all species of sea turtle was eaten and that tortoiseshell was either worked locally or exported raw. Turtle eggs were also eaten, but were rarely sold.
Nevis: According to Meylan (1983), the meat of all species was eaten but Green Turtle meat was preferred. Polished turtle carapaces were sold locally.

Hunting intensity St Kitts: Catch rates for fishermen were reported to be of the order of 10-20 turtles per year. Approximately ten people were still setting nets for turtles, most of those caught being immature Green Turtles (Meylan, 1983). Wilkins and Meylan (1984) noted landing sites for turtles at Basseterre, Sandy Point, St Paul's, and Dieppe Bay.
Nevis: Meylan (1983) reported the average annual catch per fisherman to be 5-15, with Green Turtles again being the most frequently caught. At least 12 people still fished for turtles with tangle nets. Indian Castle was reported to be the main landing site for turtles (Wilkins and Meylan, 1984).

Hunting methods Wilkins and Meylan (1984) reported the use of nets and spearguns. Towle (1986) noted that boat users often scanned beaches from off shore for turtle tracks and then came ashore to probe for eggs.

Historical trends According to Merrill (1958, cited in Towle, 1986), the Green Turtle in particular had played a major role in the subsistence of early European colonists on St Kitts. He noted reports in early records that the English and French had a number of skirmishes near the Salt Ponds over the right to hunt turtles in the area. Hunting pressure was apparently of such intensity that the Green Turtle did not survive "long enough to become an important slave food".

Historical trends were also discussed by Meylan (1983).
St Kitts: Net fishermen complained about declines in annual catches. A turtle fisherman at Dieppe reported catching 50 turtles per year in the 1960s but in 1979 caught only five turtles. The price for turtles meat increased from US$0.80 a kg in 1980 to US$1.60 a kg in 1983.
Nevis: A tortoiseshell buyer from Charlestown reported a decrease in the quantity of tortoiseshell he could purchase from fishermen on the island - from 136 a kg/year in 1975 to 91 a kg/year in 1980. Meylan stated that hunting pressure had increased during this period.

Domestic trade This was also discussed by Meylan (1983) .
St Kitts: Turtle meat was sold in many villages, occasionally in the public market in Basseterre, and also to local hotels. The price of turtle meat in 1983 was US$1.60 a kg. Some tortoiseshell was worked locally but there was little use of turtles for souvenirs. In May 1983 tortoiseshell sold for US$24 a kg.
Nevis: In May 1983 turtle meat was selling for US$1.60 a kg. When Green Turtles were abundant, they were shipped alive on the ferry or the

"lighters" to the public market at Basseterre, St Kitts. In 1983 the price was US$0.80 a kg live weight and US$2.00 a kg dressed. There was an active market for tortoiseshell and in 1980 a dealer from Charlestown was buying shell from fishermen for US$16 a kg. There was also a limited market for tortoiseshell and polished turtle carapaces in local tourist shops.

International trade St Kitts-Nevis is not a party to CITES and is not covered by the UK ratification. There appears to be very little international trade involving turtle or turtle products from these islands. Meylan (1983) noted that the dealer from Charlestown was reselling tortoiseshell from Nevis to a dealer from St Lucia, the price in 1983 ranging from US$16 a kg to US$24 a kg; and that buyers from Puerto Rico, Dominica and Guadeloupe periodically "canvassed" Nevis fishermen at their homes. Meylan (1983) also reported that the ban on importation of turtle products into the USA had apparently caused this trade to be sharply curtailed in recent years.

LEGISLATION

Turtle Ordinance, Cap 99., 1 January 1948.
Established a closed season from 1 June to 30 September inclusive. It is therefore prohibited to take, kill, sell, buy, possess etc., turtles or their eggs or meat, between 1 June and 30 September. The taking etc. of turtles under 20 lb (9 kg) is prohibited.

Fisheries Act (No.4, 1984).
Draft regulations, likely to be approved, would protect all turtles.

POPULATION: Chelonia mydas.

Nesting sites Butler (in litt., 15 September 1986) noted Green Turtle nesting mainly on a few beaches on the east coast. Murray (1984) reported nesting at Trou L'Oranger, Anse Chastanet and possibly Anse de Sables, Anse Commerette, Anse Nicoud and Honeymoon Beach.

Nesting numbers Butler (in litt., 15 September 1986) considered nesting Green Turtles to be in low abundance. Bacon (1981) and Carr et al. (1982) considered nesting to be rare. Murray (1984) estimated the population of nesting females to be six, although only two confirmed sightings were reported.

Trends in nesting numbers Butler (in litt., 15 September 1986) considered the Green Turtle nesting population to be decreasing. According to Murray (1984), fishermen indicated that the numbers of sea turtles seen in 1982 showed a significant decrease relative to 1980 and a major decrease relative to 1972. It is not certain if this included the nesting population.

Foraging sites Carr et al. (1982) noted the occurrence of numerous sheltered coves with seagrass beds and reported the presence of juvenile and adult Green Turtles all year round. Bacon (1981) reported frequent foraging by juveniles and adults and named foraging sites at Soufrière, Choiseul, Anse Sable, Micoud and from Gros Ilet to Anse Lavoutte. Murray (1984) reported approximate numbers observed foraging at the following sites: Anse Chastanet (30), Ciceron (3), Maria Islands (10) and Dennery (5).

Migration A Green Turtle originally tagged while nesting at Aves Island was captured near Vieux Fort (Carr et al., 1980).

POPULATION: Eretmochelys imbricata

Nesting sites Butler (in litt., 15 September 1986) reported nesting all along the western coast. Bacon (1981) reported nesting at Anse Becune, Pont Saline, Pigeon Is., Anse Cochon, Anse Jambon, Anse Mamin, Anse Ger, Preslin, Grande Anse, Cas-en-Bah, the mouth of the Troumassee River, and from the southern tip of the Island to Burgot Point. According to Murray (1984), nesting also occurred at Cariblue, Anse Chastanet, Dennery, Honeymoon Beach and possibly at Trou L'Oranger, Anse Micoud, Anse de Sables, Anse Commerette, Fond d'Or and Anse Lapins. Carr et al. (1982) noted that Hawksbills nested, to some extent, on nearly all St Lucia beaches.

Nesting numbers Butler (in litt., 15 September 1986) reported nesting Hawksbills to be of medium abundance. Bacon (1981) reported frequent nesting and Carr et al. (1982) noted that, together with Leatherbacks, Hawksbills were the predominant nesters on St Lucia. Murray (1984) estimated the population of nesting females to be 11, although only four confirmed nests were reported.

Trends in nesting numbers Butler (in litt., 15 September 1986) considered the Hawksbill nesting population to be decreasing. Murray (1984) concluded, from interviews with local fishermen, that there had been a major decrease in the size of the sea turtle population since 1972.

Nesting season April-October (Carr et al., 1982).

Foraging sites Bacon (1981) reported frequent foraging by both adults and juveniles at Soufrière, Choiseul, Anse Sable, Micoud and from Gros Ilet to Anse Lavoutte. Murray (1984) recorded ten individuals foraging at Anse Chastenet and five foraging around the Maria Islands.

EXPLOITATION

Commodity The major products obtained were meat and eggs from the Green Turtle and meat, eggs and shell from the Hawksbill (Butler in litt., 15 September 1986). According to Murray (1984), sea turtles have been a significant part of the diet of the coastal inhabitants of St Lucia.

Hunting intensity Murray (1984) reported three landing sites for turtles: an estimated five Green Turtles were landed at Castries in September; four Green Turtles and one Hawksbill at Canaries; and four Green Turtles at Vieux Fort in September and November. On Grand Anse Beach, one of the main nest sites, four turtles were killed by poachers in 1986 and ten in 1987. It is estimated that this represented half of the nesting females in 1987 (Bucknal, 1988).

Historical trends According to Murray (1984), the turtle industry of St Lucia began in about 1937 with live Green Turtles being shipped to England and the USA. After 1941, shipments consisted predominantly of dried Green Turtle products. Most of the trade from 1949 onwards depended on turtles imported from Aves Island, a small, off-lying island belonging to Venezuela. As many as three hundred turtles would be imported, under special licence during the closed season in St Lucia, with a proportion of the meat being sold locally until 1975. Until 1979, most of the turtles imported from Aves Island were shipped to Hamburg, F.R. Germany. Rebel (1974, cited in Murray, 1984) quoted landing estimates for 1969 as being 17 046 kg of Green Turtle and 10 909 kg of Hawksbill. The establishment of a permanent garrison on Aves Island is said to have finally brought this unauthorised exploitation under control (Carr et al., 1982).

Hunting methods Turtles were caught at sea in nets and some were turned on the nesting beaches (Murray, 1984).

Domestic trade There was some domestic trade in turtle meat and shell products (Butler in litt., 15 September 1986).

International trade St Lucia acceded to CITES on 15 December 1982. CITES annual reports for the period 1977-1985 recorded exports to Britain of one body and one shell of C. mydas; exports to the USA of one Cheloniidae shell and one C. mydas shell; and imports from Hong Kong of two bodies of E. imbricata. Japanese Customs reports show imports of raw tortoiseshell, and these are given in Table 190.

Table 190. Imports of raw bekko (kg) from St Lucia reported in Japanese Customs Statistics.

1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
345	288	332	0	489	349	152	143	267	270	362	0	0	0

A trader from St Lucia, Charles Fritz, is said to visit a number of Caribbean islands regularly to purchase shell for export to Japan (Pritchard, 1984).

LEGISLATION

Turtle, Lobster and Fish Protection Ordinance 1971, 11 June 1971.

Establishes a close season, 1 May to 31 August inclusive, when it is prohibited to fish for, kill, collect, slaughter, sell, buy or have in possession turtles or their eggs, or meat. The setting of nets etc. with intention of catching turtles is prohibited within 100 yards of the shore. It is also prohibited to kill, sell, etc. turtles of less than 15 lb (6.8 kg) and to catch or take turtles or their eggs on land.

Wildlife Protection Act (No. 9, 1980)

Authorises the Minister to make regulations for the protection of turtles. Regulations were in draft in November 1986.

ST VINCENT AND THE ST VINCENT GRENADINES

POPULATION: Chelonia mydas

Nesting sites Carr et al. (1982) noted beaches that appeared suitable as nesting sites all along the leeward coast of St Vincent. Morris (1984) reported no nesting on St Vincent Island but recorded nesting in the St Vincent Grenadines at Raffal, Frigate Island, Richmond Beach, Spring Beach, Friendship Beach and Adams Beach. Carr et. al. (1982) noted a few reports of nesting on Palm Island (Prune Is).

Nesting numbers Bacon (1981) and Carr et al. (1982) considered nesting to be rare. From interviews conducted with local fishermen, Morris (1984) concluded that there were no concentrations of nesting by any species of sea turtle on any of the islands.

Trends in nesting numbers Local fishermen believed that sea turtle populations had declined drastically over the last two decades (Morris, 1984). This does not necessarily include nesting populations.

Nesting season No specific information, but all nesting recorded by Morris (1984) occurred April-August.

Foraging sites According to Carr et al. (1982), with the exception of the south-east coast, the narrow shelf around St Vincent offered relatively little foraging habitat for sea turtles. Bacon (1981) noted occasional foraging by both adults and juveniles, and Carr et al. (1982) reported the presence throughout the year of all sizes of Green Turtle, though not in substantial numbers. In the St Vincent Grenadines, Green Turtles were reported, by Carr et al. (1982), to be far more common than on the mainland and to equal or exceed Hawksbills in numbers. Morris (1984) recorded foraging around the islands of Baliceaux, Canouan, Union and Mustique.

POPULATION: Eretmochelys imbricata

Nesting sites Nesting was reported at Richmond Beach, Barrouallie, Rose Bank, Cumberland Bay, Wallilabou Bay, Orange Hill, Colonarie Bay and Stubbs Bay (Carr et al., 1982; Bacon, 1981) Carr et al. (1982) stated that Hawksbills emerge on nearly every stretch of beach on St Vincent and on nearly all islands in the St Vincent Grenadines. Morris (1984) also reported nesting on St Vincent at Chateau Belair Bay, Petit Border Bay, Troumaka Bay, Kearton's Bay, Peter's Hope Bay, Mount Wind Bay, Lowman's Bay, Brighton Bay, Biabou Bay, South Union Bay, Georgetown Bay; and in the St Vincent Grenadines at Miss Irene, Campbell, Chatham Bay, Bloody Bay, Raffal, Frigate Island, Richmond Beach, Spring Beach, Friendship Beach, and Adams Beach.

Nesting numbers According to Carr et al. (1982), Hawksbills were the predominant nesters on St Vincent and in the St Vincent Grenadines. Bacon (1981) considered nesting to be frequent. Bullis (1984) estimated moderate to heavy nesting activity but inferred, from data presented by Morris (1984), a total number of nesting females of fewer than 20.

Trends in nesting numbers Carr et al. (1982) concluded that Hawksbills were nesting in reduced numbers on mainland St Vincent and in the St Vincent Grenadines; a large proportion of tortoiseshell exported was said to originate from Becquia, where the Hawksbill is said to be badly depleted. According to local fisherman, the sea turtle populations have declined rapidly over the last two decades (Morris, 1984).

Nesting season According to Carr et al. (1982), the nesting season is March-September on St Vincent and April-September in the St Vincent Grenadines.

Foraging sites Bacon (1981) noted occasional foraging by both adults and juveniles, and Carr et al. (1982) reported that Hawksbills of all sizes were present all year round along the west coast of St Vincent, though not in substantial numbers. Hawksbills were considered to be more abundant in the Grenadines than around St Vincent (Carr et. al., 1982; Morris, 1984) reported foraging around the islands of Baliceaux, Canouan, Union and Mustique.

EXPLOITATION

Commodity No specific information. Income was derived from the sale of whole shells and scutes, meat, and small turtles as souvenirs (Carr et al., 1982).

Hunting intensity Carr et al. (1982) considered exploitation in 1978 to be quite heavy, especially in the Grenadines.

Hunting methods A few fishermen in Chateaubelair, Rose Bank, Clare Valley and Questelles set turtle nets along the coast (Carr et al., 1982). Morris (1984) reported that in the Grenadines turtles were taken mainly by gill nets, by hand during nesting, and during offshore trawling. The use of spear guns to capture small turtles for sale as souvenirs was becoming increasingly popular (Carr et al., 1982).

Domestic trade According to Morris (1984), most whole shells originated in the Grenadines. Craftesmen paid, on average, E.C.$35-40 a lb (E.C.$77-88 a kg) for individual scutes, the price varying with the tourist season. Whole shells fetched a price of E.C.$100-160. Carr et al. (1982) noted the sale of meat and shell to tourists travelling through in sailing yachts and also referred to a French "yatchtel owner" on Union who bought turtles from local fishermen for sale in his establishment. In Kingston, few turtle products were seen for sale (Carr et al., 1982).

International trade Carr et al. (1982) referred to reported annual exports of up to 1500 lb (692 kg) of Hawksbill shell from St Vincent to St Lucia. St Vincent is not a Party to CITES. CITES annual reports for the period 1977-1985 recorded imports to F.R. Germany of 53 kg of Hawksbill scales from St Vincent. Japanese Customs reports indicate that small quantities of Hawksbill shell (bekko) were imported from St Vincent from 1973 onwards (Table 191). No imports were reported from 1950 to 1972. It should be noted, however, that any Hawksbill shell exported via St Lucia might not be recorded as exports from St Vincent.

Table 191 Imports of bekko (kg) from St Vincent reported in Japanese Customs statistics.

1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
243	250	191	130	230	144	0	0	0	36	108	242	191	470

ST VINCENT AND THE ST VINCENT GRENADINES

The quantities of bekko reported by Japanese dealers to have been imported from St Vincent between 1984 and 1986 (Tokunaga and Milliken, 1987a) are remarkably similar to those reported in Customs statistics.

LEGISLATION

Birds and Fish Protection Ordinance 1939.

Close season established from 1 May to 31 July inclusive. It is prohibited to take, destroy or have in possession any turtle or eggs from the land and to take, kill, sell or purchase turtles of less than 20 lb (9 kg).

Fisheries Act (No. 8, 1986)

Authorises the Minister to make regulations for the protection of turtles. No regulations have yet been issued.

POPULATION: Chelonia mydas

There appear to be no Green Turtle nesting records in Sudan. Some scattered, mostly small-scale, nesting would not be unexpected, and the species is known to occur in Sudanese waters (Moore and Balzarotti, 1977).

POPULATION: Eretmochelys imbricata

Nesting sites Sea turtle nesting has been recorded at most of the larger islands in the Suakin Archipelago, extending from Suakin southward to the border with Ethiopia (Moore and Balzarotti, 1977). By analogy with the situation in Egypt and Saudi Arabia, relatively little mainland nesting would be expected. All identifiable skeletal material and sightings (hatchlings, beached adults, turtles underwater) were Hawksbills, and this species appears to be the predominant nester in Sudan. Talla Talla Saghir, Seil Ada Kebir, Barn Musa Kebir, Masamirit, Daraka and Abu Isa appear to hold greatest numbers, but suspected Hawksbill nesting occurs on at least 18 of the approximately 30 islands in the Archipelago (Moore and Balzarotti, 1977), but never on those close to the mainland.

Nesting numbers In the 1976 season, around 676 nests were recorded, thought to be nearly all Hawksbills, with perhaps 270 females nesting in all in a given season. Allowing for around 60 turtles that were considered likely to nest in three unsurveyed islands, some 330 females may nest each season in the Suakin Archipelago (Moore and Balzarotti, 1977). Significant numbers, but probably not more than 50 a season, also nest on islands off Mohammed Qol in the north of the Sudan coast (also thought to be mostly Hawksbills) (Moore and Balzarotti, 1977).

On Seil Ada Kebir in early March, there were 25 Hawksbill nests less than one week old, representing a mean of over three turtles a night, and 42 nested on 1.8 km of beach 11-18 March, representing a mean of over six females nightly (Hirth and Abdel Latif, 1980). If the latter intensity of nesting is maintained for more than a week or two, this could suggest around 84 females are using the island (if re-nesting at 14-day intervals) this is more than double Moore and Balzarotti's estimate of 35 females a season. It is possible their estimate of 300-350 females a season in all Sudan is similarly conservative.

Trends in nesting numbers No precise information. Historical evidence for high levels of exploitation from Pharaonic times to at least the Middle Ages suggest that there must have been "immense" numbers of Hawksbills in the Red Sea (Hirth and Abdel Latif 1980); the inference is that present populations are markedly depleted and Red Sea populations in general are thought to be depleted (Frazier, 1982b).

Nesting season Uncertain, but extends at least from March to June; mid-June is thought to be past the peak of the season, and local informants suggested that nesting started in March (Moore and Balzarotti, 1977).

Foraging sites It has been suggested (Moore and Balzarotti, 1977) that the reef systems fringing islands in the Suakin Archipelago are so thin, and plunge so steeply into deep water, as to be unable to hold substantial numbers of adults; the extensive shallow-water coastal reef systems north of Suakin may be the major turtle feeding grounds.

Migration No specific information, see **Foraging sites** alone.

EXPLOITATION

Commodity Turtle meat and eggs are occasionally used for food in Sudan. Some Hawksbills in the region are evidently poisonous since a man who neither smokes nor consumes alcohol is generally selected to taste the liver before the nest of the turtle is eaten (Hirth and Abdel Latif, 1980). Moore and Balzarotti (1977) reported that Hawksbill meat was highly prized locally, and not considered poisonous. They indicated that the eggs were seldom eaten and the shell was usually thrown away, the locals being unaware of its value.

Hunting intensity Observations and extensive interviews indicate that relatively few Hawksbills are taken in Sudan for food or for shell. A few turtles and eggs are taken by itinerant fishermen and smugglers (Moore and Balzarotti, 1977; Hirth and Abdel Latif, 1980).

Historical trends Tortoiseshell has been recorded as an important trading commodity from the Red Sea since the first century AD, and certain Red Sea ports are known to have flourished, in part, in the tortoishell trade, in one case into the Middle Ages (sources cited in Hirth and Abdel Latif, 1980). In the 18th century, Bruce referred to a Hawksbill fishery, producing the finest shells, between Suakin and the Dahlak Archipelago of Ethiopia (cited in Moore and Balzarotti, 1977).

Large mounds of turtle bones, apparently predominantly Hawksbills, found on several islands in the Suakin Archipelago are suggested by Moore and Balzarotti (1977) to be of late 19th century origin and probably attributed to the work of European sailors using the newly opened (1869) Suez Canal. The bones are often found grouped into two mounds, one containing the plastron and carapace and the other the skulls and limb bones, indicating that the turtles were probably cut up *in situ* for meat. Informants of Hirth and Abdel Latif (1980) confirm that Hawksbills have not been taken on Seil Ada Kebir for at least a generation.

Domestic trade There is evidently little domestic trade in turtle products, most of the meat being used for subsistence purposes. Fishermen interviewed by Hirth and Abdel Latif (1980) indicated that there was no tourist market for shell products but if one developed they would be able to supply it.

International trade Although Sudan was historically very important in tortoiseshell trade (see above), there is no evidence of continuing international trade. The only records in CITES Annual Report were of two shells of *C. mydas* and one of *E. imbricata* which were illegally imported from Sudan to Denmark in 1984. Sudan ratified CITES on 26 October 1982.

LEGISLATION

Wildlife Conservation and Parks Act, 1975 (cited in Hirth and Abdel Latif, 1980).

All Chelonia are protected and may not be hunted without a special permit.

POPULATION: Chelonia mydas

Nesting sites Much of the Suriname coast consists of mudflats and mangrove; sandy beaches suitable for turtle nesting extend only for some 60 km (Mohadin and Reichart, 1984; Schulz, 1975). Most turtle nesting occurs in the Galibi-Baboensanti-Eilanti area at the mouth of the Marowijne River (bordering French Guiana), and at Matapica-Krofajapasi, formerly known as Bigisanti (Schulz, 1982). The latter beaches used to be within the Wia Wia Nature Reserve, but coastal erosion has resulted in their westwards migration, and they are now outside the Reserve boundary. Most C. mydas nesting takes place on beaches bordering the Marowijne delta south-east of Eilanti, some 19 km in all, being most concentrated on a 2-km stretch known as Baboensanti (Schulz, 1975).

Nesting numbers Staff of the Suriname Forest Service and of the Foundation for Nature Preservation in Suriname (STINASU) have been systematically collecting nesting data since 1967. Schulz synthesised a great deal of information in his 1975 publication, from which most of the data presented in Table 192 are taken. The mean number of nests per night on Bigisanti, Eilanti and Baboensanti, between mid April and late June 1968 was 37 (Schulz, 1975). Schulz (1975: p. 86) estimated the average annual female nesting population between the years 1968-1974 as 1500-2000.

Trends in nesting numbers No marked change in the number of nests laid can be discerned between 1968 and 1985. Schulz (in Bacon et al., 1984, Vol. 1: p. 198), considering the data up to 1982, suggested a recent slight upward trend in female numbers was evident; he was not aware of any historical data on long-term trends in Suriname. Eggs have been harvested for food since at least the 19th century, but turtles were apparently not taken for food on a large scale except for a few years prior to World War II; the available harvest information (Schulz, 1975) could be interpreted to suggest that nesting numbers after the War were lower than before, but this is far from conclusive.

Nesting season Nesting by C. mydas takes place between February and July, with a peak in April-May (Schulz, 1975).

Foraging sites No seagrasses or algae, the primary diet of C. mydas, occur off the Suriname coast; the Suriname nesting population forages mainly, or entirely, along the coast of Brasil (Schulz, 1975). Young C. mydas, just one or two years old, are frequently caught at the mouth of the Suriname River, but this age class is suspected to be omnivorous and may feed in the area before migrating to distant feeding grounds and shifting to a vegetarian diet (Schulz, 1975).

Migration Between 1966 and 1975, 73 females tagged at Bigisanti and Galibi had been recovered in distant waters; except for one from Cayenne (French Guiana) all were recovered off the coast of Brasil, from the state of Amapa east and south to Alagoas. Most, around 60%, were caught off the coast of Ceara (Schulz, 1975). Turtles nesting on Ascension Island also forage off the Brasilian coast, mainly to the south of the Suriname nesters, although the two populations overlap along some 1200 km of coast between Acaraú and Maceió (Schulz, 1975).

Table 192. C. mydas nesting numbers, in total, and at major beach areas, in Suriname (most data from Schulz, 1975, Table 17; 1982). The Baboensanti column includes beach count data plus extrapolation for beaches not monitored. The upper and lower limits of the annual nesting female numbers are based on the assumption, respectively, of three or four nests per female per season. The 1977-1982 annual female totals are from Mohadin and Reichart (1984, Table 6); their estimates of total breeding female numbers have been re-converted to females per year, by dividing by the mean inter-breeding interval of 2.3 years (Schulz, 1975). The 1980-1985 total nest figures were kindly provided by the Suriname Forest Service (F.L.J. Baal in litt., 11 September, 1986), and the 1986-1987 figures by STINASU (K. Mohadin in litt., 17 October 1988).

Year	Nests				Annual nesting females
	Bigisanti	Eilanti	Baboensanti Pruimenboo Galibi	Suriname Total	
1967	1025	861			
1968	750	780	3400	5000	1250-1700
1969	780	420	1260	2495	650- 850
1970	840	472	1800	3115	775-1050
1971	950	790	4015	5755	1400-1900
1972	1080	730	5150	6885	1700-2300
1973	1033	802	4625	6600	1650-2200
1974	1438	619	5300	7465	1850-2500
1975	772	105	2675	3610	850-1100
1976				8080	
1977				4955	2087
1978				8465	3130
1979				4330	1957
1980				4510	1739
1981				7410	2609
1982				4180	1522
1983				5547	
1984				7546	
1985				5125	
1986				5879	
1987				6324	

POPULATION: Eretmochelys imbricata

Nesting sites The Hawksbill is very rare in Suriname waters (Schulz, 1975). Sandy beaches suitable for turtle nesting extend for some 60 km (Mohadin and Reichart, 1984; Schulz, 1975). Most turtle nesting occurs in the Galibi-Baboensanti-Eilanti area at the mouth of the Marowijne River (bordering French Guiana), and at Matapica-Krofajapasi (formerly known as Bigisanti (Schulz, 1982). Nesting by E. imbricata has been recorded at Bigisanti and Galibi beaches (Schulz, 1975) and at Matapica-Krofajapasi (Mohadin, in litt.).

Nesting numbers The E. imbricata population nesting in Suriname is very small indeed (Table 193). All of the nests from 1967 to 1975 were on

Bigisanti Beach except for a total of six made on Galibi beach between 1970 and 1975.

Table 193. Nests of E. imbricata on Suriname beaches, 1967-1975 (data from Schulz, 1975), 1976-1984 (data from Reichart, 1987) and 1986-1987 (data from Mohadin *in litt.*, 1988).

Year	Nests	Year	Nests
1967	10	1976	45
1968	4	1977	7
1969	10	1978	10
1970	3	1979	?
1971	14	1980	26
1972	12	1981	25
1973	7	1984	19
1974	29	1986	21
1975	14	1987	11

Nesting season Most of the few nests made annually in Suriname have been recorded between May and July; it is suspected that some earlier nesting may occur in some years, but none after August (Schulz, 1975).

THREATS

The dynamic geomorphology of the coastline, involving large scale changes in the availability of nesting habitat, and significant loss of nests due to wave action, may have an appreciable effect on reproductive output. Schulz (in Bacon *et al.*, 1984, Vol. 1: p. 198) stressed that the harvest of 250 000 *C. mydas* eggs annually in 1967-1983 should be considered when assessing the conservation status of the Suriname population, implying a possible negative effect on recruitment. Others, notably Reichart (*in litt.*, 13 September 1984, to USA CITES Management Authority), have clearly stated an opinion that the egg harvest is excessive (the 1984 harvest was reportedly increased to 400 000 eggs, not all of which were *C. mydas* however; see below). A harvest of 250 000 eggs would constitute around 25% of the total annual *C. mydas* reproductive output (Reichart, 1982; Anon., 1985e). However, the majority of eggs collected is from nests considered to be doomed to destruction by tides (Reichart, 1982).

EXPLOITATION

Commodity The principal turtle commodity used in Suriname is the eggs of *C. mydas*. Turtles have in the past been exploited for meat and shell, but not to any great extent. The coastal Caribs do not like the flavour of the meat, although an older explanation (Chrétien, 1725, cited in Schulz, 1975) for their dislike of turtles ("ils craindroient s'ils en mangeoient de participer à la stupidité de cet animal"), is more colourful, if less flattering to the turtles. Reichart (1987) attributed the apparent absence of poaching to the work of the beach patrols. No adults are known to have been taken since 1964, according to Mohadin (*in litt.*, 1988).

Hunting intensity The level of egg harvest is managed by a combination of legal control and market manipulation. The account that follows is derived partially from Schulz (1975) with recent information from F.L.J. Baal (pers. comm., 1986).

Eggs may only be collected between 1 March and 31 May, which coincides with the peak nesting season of C. mydas, but avoids the nesting season of L. olivacea. During the open season, there is free access to a stretch of beach whose limits are determined annually, where virtually all of the eggs laid will be harvested. It is estimated that this amounts to about 7% of all the nests laid in Suriname. Virtually all of the remaining nesting is within nature reserves and areas without free access, and harvesting is under the control of STINASU. As new beaches are formed in the west, the area of free access is moved to the west also, and is thus being reduced (Mohadin, in litt.). Between Galibi and Matapica River, permits are only issued for the collection of eggs from erosion areas. In Galibi Reserve, the local Caribs are employed to collect eggs under a quota system. The eggs remain the property of STINASU, who then market them in Albina and other towns. In addition to being paid to collect and transport the eggs, the locals receive a revenue for every 1000 eggs collected, which is paid directly into village funds. The remuneration received by the Caribs under this system is probably higher that they would derive from an unlimited harvest regime, but there has periodically been some resentment of such an infringement of their traditional rights. In spite of this, control is thought to be good and the quotas are substantially adhered to. It has been estimated (Anon., 1985e) that the level of illegal egg poaching is about 2-5% of the legal harvest.

Schulz (1975) detailed the egg harvests taken between 1970 and 1973, see Table 194. Since then, official reports (Anon. 1985e; Mohadin and Reichart, 1984) have stressed that the egg harvests have not exceeded 250 000. Although Reichart (in litt., 13 September 1984) has indicated that harvests of 300 000-400 000 eggs have regularly been taken, Mohadin (in litt., 17 October 1988) pointed out that this resulted from a misinterpretation of the harvest data and reaffirmed that harvest of C. mydas has not reached these levels. The 1984 harvest did amount to 400 000 eggs but comprised 225 000 C. mydas and 175 000 Dermochelys eggs, and this total was far lower than the number that would have been destroyed by erosion and inundation (Mohadin, in litt.). Leatherback eggs have also been harvested in 1986 and 1987. These reports imply that the annual levels of harvest have been around 27-69% of the total eggs laid each year (see Table 194). Attempts are apparently being made gradually to reduce the quotas under negotiation with the locals.

Hunting methods No hunting techniques have been documented except for the collection of eggs and, prior to 1964 at least, of nesting females from the beaches.

Historical trends Schulz (1975) documented the early history of turtle exploitation in Suriname. Green Turtles were killed for meat as early as 1686, but not on a large scale until just before World War II. At that time, a merchant in Albina operated an export trade in Green Turtles, possibly taking as many as 3000 turtles in 1938 and 1939. The trade stopped in 1940 and has not been resumed. Poachers continued to take small numbers of nesting turtles along the coast during the 1950s, but the main exploitation has always been of eggs. The intensity of egg collection gradually increased under the influence of growing demand and rising prices until, in 1967, it was estimated that 90% of all the eggs laid by C. mydas and a

Table 194. Estimates of the total number of eggs laid, the number legally harvested and the percentage of total production that this represents. Also given are the number of doomed eggs transplanted, the hatching success of these transplanted eggs, and the numbers of hatchlings retained for rearing in the ranch: 1970-1973 from Schulz (1975); 1978-1982 from Mohadin and Reichart (1984); 1984-1985 from F.L.J. Baal (in litt., 1986) 1983, 1986-1987 data from K. Mohadin (in litt., 17 October 1988). Figures in brackets were calculated from the number of nests (see Table 192), assuming an average clutch size of 138 (Schulz, 1975).

Year	Total	Harvest		Hatchery		
	Eggs laid	Eggs	%	Transplant.	Hatched	Retained
1970	(429870)	260000	60	40000		
1971	794000	417000	53	80000		
1972	950000	430000	45	70000		
1973	894000	540000	60	65000		
1978	(1168170)			38545	74.1	2434
1979	(597540)			52317	67.0	3996
1980	(622380)	250000	40	50131	67.1	11502
1981	(1022580)	250000	24	39865	68.6	11420
1982	(576840)	250000	43	26700	72.3	7722
1983	765486	200000	26			
1984	(1041348)	225000	22	(125028)		0
1985	(707250)	175360	25	(43332)		0
1986	811302	175000	22			0
1987	872712	193000	22			0

higher percentage of L. olivacea eggs were harvested. Conservation measures were instigated in 1967, resulting in the gazetting of the Galibi Nature Reserve in 1969. The harvests since that date are shown in Table 194.

Domestic trade The eggs harvested from the Galibi Nature Reserve are marketed in local towns by STINASU, and the revenue from these sales is used for the turtle conservation programme. The price of the eggs is deliberately kept low to reduce the incentive for the poaching and illegal sale of eggs. In 1986, they sold for 20 cents each, about half the price of hens' eggs. As the number of eggs harvested under the control of STINASU is greatly in excess of the number of eggs harvested by independent collectors (about 7% of the total production), this effectively swamps all competition, and establishes a nation-wide price for turtle eggs (Schulz, 1975; F. Baal pers. comm., 1986).

International trade Suriname acceded to CITES on 17 November 1980, but took reservations on C. mydas and D. coriacea. CITES Annual Reports record the export of large numbers of specimens of C. mydas for scientific purposes, mostly to Canada, the USA and the UK. Apart from these, the only trade recorded in sea turtle products was the export of one shell of C. mydas to China in 1983 and the import of one shell of E. imbricata to the USA in 1983 and one in 1982.

The Customs reports consulted contained no record of any trade in turtle products with Suriname. From 1968 to 1978 a total of 27 300 eggs of C. mydas were exported to Cayman Turtle Farm (Weber et al., 1983).

SURINAME

LEGISLATION

The Game Law 1954.

Prohibits the hunting, transport, trade, sale, gift, import or export of sea turtles (Applies only to the northern [i.e. coastal] part of the country)

Executive order under articles Nos. 1, 6, 11, 22 and 23 of the Game Law of 1954 (GB 1954 No. 25), 1 October 1970.

Applies only to northern portion of country

These species and subspecies are protected (hunting and trade prohibited) but their eggs may be collected during a certain period (1 March-31 May):

C. caretta
C. mydas mydas
E. imbricata imbricata
L. olivacea
D. coriacea

Quotas for collection of eggs by STINASU (employing local Amerindians) in the Galibi Nature Reserve are set annually. The eggs are sold along the streets by the Foundation for Nature Preservation (STINASU).

November 1982 amendments to the above extended the reach of the law to include the whole country.

Suriname became a Party to CITES on 17 November 1980, but has reservations for *C. mydas* and *D. coriacea*.

RANCHING/HATCHERIES

Many of the nests are laid on parts of the beach inundated by the tide or subject to erosion. Since 1964, there has been a policy of removing the eggs from these nests and either taking them to central hatcheries or, more recently, reburying them in safer areas higher up the beach. The numbers of eggs moved in this way, and the percentage hatching success are shown in Table 194.

In 1977, an experimental ranching project was started, using a proportion of the hatchlings from the relocated eggs. The numbers of hatchlings retained are shown in Table 194. Various rearing techniques were investigated, including floating cages and tanks on shore, but the system that was eventually adopted comprised a mud-sided creek in the bank of a tidal river, fenced off with bamboo partitions and having the water level controlled by a sluice. The scheme was seen chiefly as a conservation measure, as a proportion of the young turtles were to be released after head-starting for one or two years. The remaining stock was to be reared for three or four years for the production of meat, shell, oil and leather for export. The food for the turtle ranch was all imported and was thus not only expensive but also a drain on the country's foreign exchange reserves. It was hoped that exports of turtle products would to some extent compensate for the need to import food, and there were plans to manufacture the food in Suriname itself (5000 head-started 8-12 month old *C. mydas* were released in 1984 (Pritchard, 1987b). No hatchlings have been taken for the ranch since 1984 (Mohadin *in litt.*, 1988).

A proposal was prepared for the 4th Meeting of the Conference of the Parties to CITES held in April 1983, to transfer the Suriname population of C. mydas to Appendix II. Concern was expressed that the marking procedures outlined in the proposal were inadequate and the Screening Committee was unable to reach a unanimous agreement on the proposal. When the proposal was discussed in plenary session, it was rejected, but the conference approved the general principle of the ranching operation, and made a commitment to accept the proposal subject to further information on marking procedures being submitted to and accepted by the CITES Tecnical Committee. The Tecnical Committee met in June 1984 and approved the details of the marking procedures which had been submitted by Suriname. A revised proposal was prepared for the 5th Meeting of the Conference of the Parties to CITES, held in 1985, in the expectation that its acceptance would be a formality. In the Plenary session, discussion was restricted by the Chairman to aspects of the marking system, and the proposal was eventually rejected on the grounds that the marking was inadequate, thereby over-riding the decision of the Tecnical Committee and the recommendation of the CITES Secretariat. Following this unfavourable decision, plans to manufacture the food locally were dropped and the ranch was discontinued. There was no stock remaining at the ranch in 1986 (F.L.J. Baal, pers. comm.).

POPULATION: **Chelonia mydas, Eretmochelys imbricata**

Both species occur in Taiwanese waters, but the statement (Chu-chien, 1982) that nesting in the region is restricted to the islands of the South China Seas implies that nesting on Taiwan, if any, is of little significance. However, some nesting by both species occurs in the nearby Nansei Shoto group (Japan), and may be suspected on Taiwan. Mao (1971) recorded that both species occur in Taiwan waters. His comment that the eggs of both are palatable might imply that some nesting occurs in Taiwanese territory, however, Mao provided no confirmation of this. The Green Turtle can be found at "various parts" of the Taiwan coast, and is "very common" at Nanfangao; it is recorded mainly in December-January and is very rare in June-September. No detailed information is available.

EXPLOITATION

Mao (1971) noted that Green Turtle meat was much sought after in the past and was still recognised as a delicacy by coastal peoples; plastrons of C. mydas were ground up to be used in chicken food or were sold to Chinese medicine shops. Hawksbill meat is also eaten, as, apparently, are the eggs of both species. According to Mao (1971) "for four hundred years, much of the best shell has been sent to Shanghai and Singapore for exportation, and in Japan there is also a flourishing trade in tortoiseshell", and "in China they are commonly used for making frames of glasses, necklaces, ear-rings, pads for tea cups and many other artistic articles".

International trade Taiwanese Customs reports record imports and exports of tortoiseshell under a variety of commodity headings. Raw tortoiseshell is reported as "Kuei Pan (Shell, tortoise), 05090410", "Pien chia k'o (Amydae carapax), 05090420", and "Other tortoise-shell (Shells and scales), 05090490". Worked tortoiseshell was reported under several categories before 1981, but since then has featured as "Plates, sheets, rods, strips, tubes and other pieces cut to shape, of tortoiseshell, 95050120" and

Table 195. Sources of imports of "Kuei pan (Shell, tortoise)" (kg), Category 05090410, reported in Taiwan Customs statistics.

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Australia	–	–	–	–	–	–	–	200	–	–	–	–
H. Kong	–	–	–	6490	6500	–	85	494	16150	30916	38493	25503
India	–	45	–	–	–	–	–	–	–	–	–	–
Indo'sia	19	2650	12818	2780	30021	16998	100	3772	–	–	1768	–
Japan	69	300	300	253	293	–	96	–	–	–	–	–
Malaysia	22	1900	–	–	–	–	–	–	–	–	–	–
Ph'ppines	–	–	5475	2230	930	1524	190	–	–	–	–	87
S'pore	1850	2250	4200	12411	26980	20900	8242	8500	18850	3702	20810	15007
Thailand	–	1500	7450	3920	29180	30	–	–	–	–	–	–
USA	–	235	–	–	–	–	–	–	–	–	1238	–
Viet Nam	–	1600	–	–	–	–	–	–	–	–	–	–
Others	323	9127	22184	9620	34942	22835	570	–	1253	2544	–	–
Total	2904	19607	52427	37704	128846	62287	9283	12966	36253	37162	62309	40597

Table 196. Destinations of exports of worked tortoiseshell (kg), Category 9501 prior to 1981, and Categories 95050110 and 95050210 since 1981, reported in Taiwan Customs statistics.

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Australia	-	646	-	-	-	-	-	439	5532	599	16	-
Austria	-	-	-	-	-	-	2	-	35	-	-	-
Bahrain	-	-	-	-	-	-	-	-	100	-	-	-
Belgium	-	-	51	34	-	-	48	16	-	-	-	-
Canada	-	-	-	-	-	1070	-	23	-	-	-	-
Cyprus	-	-	-	-	-	-	-	-	8	-	-	-
Denmark	-	-	-	4	4	-	-	-	-	-	-	-
Domin. Rep.	-	-	-	-	-	-	-	-	1209	-	-	-
Fiji	-	-	-	-	5	-	-	-	-	-	-	-
France	-	-	14	44	146	-	5	68	27	29	96	-
Germany FR	-	26	6	3	9	-	11	-	2027	5	-	88
Greece	-	-	-	-	-	-	-	-	-	-	148	-
Hong Kong	-	-	-	-	-	-	88	116	-	95	2	-
Italy	-	5	45	49	18	-	39	62	28	50	262	297
Japan	3506	3969	4408	79	515	2560	533	6449	516	3526	1467	-
Kiribati	-	-	-	-	-	-	-	-	50	-	-	-
Kuwait	-	-	-	-	-	-	-	-	-	389	-	-
Malaysia	-	-	-	-	-	-	3	-	-	-	2340	-
Mauritius	-	-	-	-	735	-	-	-	-	-	-	-
Netherlands	-	-	-	-	-	-	-	-	6	-	-	-
New Zealand	-	-	-	-	3	-	-	5	-	-	-	-
Norway	-	-	-	-	-	-	-	-	564	-	-	-
Panama	-	-	-	1	-	-	-	-	-	-	-	-
Philippines	-	-	254	-	-	1126	36	-	-	-	-	-
P. Rico	-	-	-	-	-	-	-	30	-	-	-	-
S. Arabia	-	41	-	-	-	-	-	213	-	2	-	9030
Singapore	-	-	-	2	-	-	17	30	-	-	-	-
S. Africa	49	-	-	36	-	-	-	12	736	-	-	-
Spain	-	7	1	9	440	1917	-	-	-	-	-	-
Sweden	-	-	-	-	-	-	-	-	84	-	-	-
Trinidad	-	-	-	140	-	-	-	-	-	-	-	-
UK	-	-	-	-	1	-	-	-	1222	-	1464	-
USA	931	30563	1265	2530	337	2373	345	3719	2021	814	3228	1305
US Pacific	-	-	-	-	-	-	-	5	152	-	-	-
Venezuela	-	-	-	-	-	-	-	-	265	-	-	-
Others	-	-	-	53	5	668	112	19	-	517	-	-
Total	4486	35257	6044	2984	2218	9714	1239	11206	14582	6026	9023	10720

Articles of tortoise-shell, 95050210". With few exceptions, Taiwan has been an importer of raw shell and an exporter of worked shell. Imports and exports of these are shown in Tables 195 and 196. It is not known exactly what commodities are traded under each category classification, but it is believed that "Amydae carapax" represents shell of freshwater turtles, _Amyda_ being a synonym of _Trionyx_. Some of the other shell imported may well be other freshwater turtle shell used for medicinal purposes, but the fact that worked shell is exported suggests that at least some _E. imbricata_ shell is

imported. In recent years, most of the "Kuei pan" imported has come from Hong Kong and Singapore (Table 195), presumably re-exported from other sources, and so it is difficult to say what the true volume or source of sea turtle shell in trade has been. Much of the worked tortoiseshell exported has gone to Japan, but the USA, Australia and, recently, Saudi Arabia have featured as major destinations.

Taiwan is not a Party to CITES. CITES Annual Reports record few transactions in sea turtle products with Taiwan, and apart from a single export of 17 kg of oil from the Cayman Islands in 1985, all have involved the import of various mostly personal goods to the USA, totalling 151 items between 1977 and 1984.

POPULATION: Chelonia mydas

Nesting sites Nesting is known on the mainland, but it is sparsely distributed and of little significance (Frazier, 1974 and 1976a). Most nesting in Tanzania occurs on the smaller and more remote offshore islands. Maziwi has been cited as the most important C. mydas breeding ground, not only in Tanzania but in East Africa as a whole (Frazier, 1976b); other important sites include North Fonjove, Shungu-Mbili, Niororo and Bariakuni, all in the vicinity of Mafia Island.

Maziwi Island, apparently the major Tanzanian nest site for both C. mydas and E. imbricata, is reported to have effectively disappeared, due to erosion (or perhaps tectonic movements) (Anon [Reuter] 26.3.82, UNEP Regional Seas No.11). These reports do not seem to have been confirmed definitively, and the present condition of the nesting populations is unknown.

Nesting numbers Although C. mydas is relatively common in Tanzanian waters (Frazier, 1982), the majority of these are foraging migrant animals and relatively few nest in the country. According to Frazier (1982), fewer than 200 are estimated to nest annually on Maziwi, with perhaps 100 at all other sites combined, giving an estimated annual total for all of Tanzania of only 300. Frazier (1976b) had earlier estimated an overall total of fewer than 200. At peak times on Maziwi, the major nest site, up to three females a night nested, and nearly ten a week (Frazier, 1976b); this is low-level nesting in world terms (see previous paragraph).

Trends in nesting numbers No long-term survey data are available, but Frazier 1976b) believes that numbers have been reduced since prehistoric times; the inferred decline is attributed to exploitation (more intense in the past), habitat loss and disturbance (more intense in recent years).

Nesting season Most nesting appears to occur June-October (Frazier, 1982), although it may vary between different sites (Frazier, 1976a), and in Maziwi is at a height in July-August, during the south-east trade winds (Frazier, 1976b).

Foraging sites Extensive marine shallows and seagrass pastures occur in Tanzanian territory, notably around Zanzibar and Mafia Islands, in Tanga and Kilwa bays, and elsewhere (Frazier, 1974), but no information is available on preferred sites.

Migration Most C. mydas occurring in Tanzania are suspected to be migrants from breeding grounds in the western Indian Ocean, or Somalia and the Arabian Peninsula (Frazier, 1974), but there may be a small resident population (Frazier, 1982). The only recoveries reported from a brief tagging programme on Maziwi Island were of three C. mydas from the Zanzibar Channel, off Zanzibar Island and the north of Pemba Island, none more than 150 km distant (Frazier, 1981).

POPULATION: Eretmochelys imbricata

Nesting sites The species is suspected to nest widely but diffusely; Maziwi is the main site used, but no other site-specific information is available (Frazier, 1974 and 1982).

TANZANIA

Maziwi Island, apparently the major Tanzanian nest site for both C. mydas and E. imbricata, is reported to have effectively disappeared, due to erosion (or perhaps tectonic movements) (Anon. [Reuter] 26 March 1982, UNEP Regional Seas No. 11). These reports do not seem to have been confirmed definitively, and the present condition of the nesting populations is unknown.

Nesting numbers According to Frazier (1982), around 50 females may nest annually in Tanzania, with perhaps 20 of these on Maziwi alone (see previous paragraph).

Trends in nesting numbers No detailed information is available, but Tanzanian turtle populations in general are suspected to be depleted. The inferred decline is attributed to exploitation (mainly in the past), disturbance and habitat loss (Frazier, 1982).

Nesting season Most nesting appears to take place February-March (Frazier, 1982).

Foraging sites Little site-specific information is available, but suitable coral reef zones, which may harbour foraging turtles, are concentrated around Zanzibar, Mafia, Maziwi Islands, and Kilwa, and are more scattered north of the Rufiji river (Frazier, 1974).

EXPLOITATION

Commodity The meat of C. mydas is widely eaten in Tanzania, though eggs are apparently not dug up. The trade in Hawksbill shell has a long history but involves more shell imported from neighbouring countries than that caught locally (Frazier, 1980a).

Hunting intensity The annual crop of C. mydas is said to be about 500 a year (Frazier, 1980a).

Hunting methods Most of the turtles are caught on the beaches, but there is a small net fishery in the south of the country (Frazier, 1980a). Older reports (see Loveridge and Williams, 1958) indicate that the fishermen around Zanzibar used to use remoras for catching turtles.

Historical trends Zanzibar has featured as a major entrepot in tortoiseshell trade since the first century A.D. (Frazier, 1980a), and turtle populations have probably been depleted since prehistory (Frazier, 1980a). It is believed that exploitation was greater in former years (Frazier, 1974). In the early 1960s, a Kenyan company (q.v.), run by the Whitehead brothers, was involved in fishing turtles off Tanganyika for export from Mombasa, although they reportedly caught few turtles (I. Robertson in litt., 10 June 1987).

Domestic trade Green Turtle meat was said to sell in Zanzibar for US$0.50 a kg (Frazier, 1980a). Despite regulations to the contrary, turtle carapaces are said to be openly on sale in Dar es Salaam (K.M. Howell in litt., 20 February 1987).

International trade Frazier (1980a) documented the early international trade in tortoiseshell from Zanzibar. From 1891 onwards, annual imports averaged 2300 kg and exports averaged 2600 kg. Between 1920 and 1963, the mainland regularly sent shell to Zanzibar, at an average level of 540 kg a

year. Japanese Customs reports show that from 1964 to 1976 Tanzania was the major source of bekko in Africa, after which it was superseded by Kenya (Wells, 1979). Recent imports are shown in Table 197.

Tanzania ratified CITES on 29 November 1979 but has regularly exported sea turtle products since then, in spite of having no reservations on these species. Annual Reports have been submitted every year from 1982 to 1985, and all records of sea turtle contained in them are shown in Table 198. Two commercial shipments of shell were recorded in the 1982 report. The EEC Annual Report for 1985 indicated the import of 40 kg of scales of _E. imbricata_ from Tanzania to France. These data may indicate major infractions of CITES: first because, in 1982, export permits were issued for commercial exports of Appendix I material, and secondly because subsequent exports to Japan have apparently not been reported in Annual Reports. There is some evidence that some exports from Tanzania to Japan may have been routed via a company in the UK (T. Milliken _in litt._, 19 August 1986). There is no indication of why France apparently issued import permits for an Appendix I species in 1985.

Table 197. Imports of tortoiseshell from Tanzania reported in the Customs statistics of importing countries. All quantities in kg.

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Hong Kong	1561	1478	308	215	0	604	0	0	0	0	0	0
Japan (Bekko)	1719	2152	1474	1410	5943	1202	845	836	168	540	1032	133
Spain	63	143	54	0	-	-	-	-	-	-	-	-

Table 198. All exports of _C. mydas_, _E. imbricata_ or unspecified sea turtle products reported in Tanzanian CITES Annual Reports.

Year	Commodity	Species	Importer	Purpose
1985	1 shell	_C. mydas_	Finland	(Personal)
1983	3 kg shells	Cheloniidae	Belgium	(Personal)
	2 shells	Cheloniidae	Canada	(Personal)
	1 shell	Cheloniidae	Denmark	(Personal)
	1 shell	Cheloniidae	Finland	(Personal)
	2 kg shells	Cheloniidae	UK	(Personal)
	2 shells	Cheloniidae	UK	(Personal)
	2 shells	Cheloniidae	Italy	(Personal)
	1 shell	Cheloniidae	Norway	(Personal)
	1 shell	Cheloniidae	USA	(Personal)
1982	2 shells	_Chelonia_ sp.	Kenya	(Personal)
	170 kg shell	_C. mydas_	Singapore	(Commercial)
	1 shell	_C. mydas_	France	(Personal)
	1 shell	_C. mydas_	UK	(Personal)
	2 shells	_C. mydas_	Sweden	(Personal)
	181 kg shell	_E. imbricata_	Hong Kong	(Commercial)
	1 kg shell	_E. imbricata_	Sweden	(Personal)
	1 shell	_E. imbricata_	Saudi Arabia	(Personal)

TANZANIA

LEGISLATION

Fisheries (General) (Amendment) Regulations 1975.

It is prohibited to catch, export or trade in turtles, or their products, without a licence.

POPULATION: Chelonia mydas

Nesting sites Many sea turtle nesting sites are known in Thailand, and, while detailed information is not available for all, C. mydas is likely to nest at most. Polunin (1975) notes the following turtle nest sites, arranged here by location and with confirmed C. mydas beaches marked by an asterisk.

West coast/Andaman Sea

*Ko Adang group (within Tarutao National Park, Satun Province)
Pha Nga Province coast
*Ko Phuket
Similan Islands
Sulin Islands

East coast/Gulf of Thailand

*Ko Khram (Chonburi Province)
Pattani
Ko Kra
Ko Kut/Ko Chang group (Trad Province)

Nesting numbers According to Polunin (1975), Thailand's most important nesting beaches, none of which he considers of major significance on a global scale, are Ko Khram, the Ko Adang group, and the coast of Pha Nga Province. The right to harvest turtle eggs on most nest beaches is leased annually; the reported total of eggs collected is considered to be close to the total egg production, and can thus be used to assess nesting numbers. Polunin (1975), on the basis of egg collection and hatchery data, estimated the total annual egg production in Thailand to be around 400 000 (Table 199); he considered it unlikely that more than 1000 females (of all species) bred in the country each season. C. mydas was reportedly by far the commonest nester in Tarutao National Park (Polunin, 1975), the most common species in the Gulf of Thailand (Bain and Humphrey, 1980), and may be the most common species in the Thai waters generally, although Mortimer (in litt., 12 May 1988) noted that L. olivacea may now be more common in Tarutao National Park. Fewer than 550 clutches (all species) are now laid annually on the west coast, and in 1987 250-270 were laid at Ko Khram, where most east coast nesting occurs (Mortimer, 1988b). Assuming three clutches per female, this corresponds to an annual nesting complement of around 180 and 80 females on the west and east coast respectively. The majority will probably be C. mydas with some L. olivacea and fewer Eretmochelys.

Trends in nesting numbers Bain and Humphrey (1980) state that C. mydas was formerly abundant on islands in the Tarutao National Park (comprising the Ko Adang and Ko Tarutao group), but had recently declined there, as in Thai waters generally. A particularly rapid decline in turtles nesting in Tarutao National Park is also reported by Ginsberg (1981). No C. mydas were found to nest during surveys in the 1981-1982 season, although not all beaches were patrolled (Saisorn, 1983). Piyakarnchana (1985) suspects that numbers generally have decreased very rapidly, although he acknowledges the lack of quantitative data. Polunin (1975) stated that present nesting beaches certainly once supported "a far greater population" of turtles than at the time of his writing. This is supported by egg collection data from Ko Khram indicating a 70% decline in yield in the decade 1963-1973. On the other hand, yields in two of the three districts of Pha Nga Province have remained more or less steady 1964-1973, while it has declined by some 40% in

the third (Table 200). L. olivacea is said to be more common than C. mydas in Pha Nga and Phuket Provinces (J. Mortimer in litt., 12 May 1988).

Nesting season Polunin (1975) reported that most sea turtle nesting on Thailand's west coast, facing the Andaman Sea, takes place in December-March, during the north-east monsoon, but peak nesting on the east coast (Gulf of Thailand/South China Sea) is in March-September, roughly corresponding to the south-east monsoon period. In Tarutao National Park (west coast) C. mydas starts nesting in late September and continues sporadically from January to late March, the peak being in late October (Ginsberg, 1981).

POPULATION: Eretmochelys imbricata

Nesting sites Species-specific information is scarce, but E. imbricata is reported to nest at Ko Klang and Ko Kai in Tarutao National Park, Ko Kra and Ko Rung in the Ko Kut/Ko Chang group (near the Thai-Kampuchea border), Ko Kra (in the Gulf, off the Thai Peninsula), Similan Islands, Sulin Islands, Songkhla Province, Pattani Province, and Narathiwat Province (Bain and Humphrey, 1980; Polunin, 1979; J. Mortimer in litt., 12 May 1988).

Nesting numbers Few details are available. The C. mydas: Eretmochelys nesting ratio was said to be around 4:1 at Ko Khram and 5:3 at Ko Kra (the southern of the two islands with the name) in 1956 (sources cited by Polunin, 1975). Some 171 000 eggs were harvested under licence at Ko Khram at this time, around 34 000 E. imbricata eggs may have been laid, perhaps indicating about 100 females a season. However, as noted for C. mydas (above), nesting on Ko Khram (as measured by egg yield) has declined by 70% between 1955 and 1973, and is likely to have declined further since. Mortimer (in litt., 12 May 1988) reported that on Ko Khram there were 70 E. imbricata and 200 C. mydas nests in 1988. The estimated egg yield at Ko Kra was put at 10 000 by Polunin (1975); this could suggest some 3750 Eretmochelys eggs and perhaps ten females a season. Only six nests were found during beach surveys (not covering all beaches) in the 1981-1982 season in Tarutao National Park (Saisorn, 1983). Fewer than 550 clutches (all species) are now laid annually on the west coast, and in 1987 250-270 were laid at Ko Khram, where most east coast nesting occurs (Mortimer, 1988b). Assuming three clutches per female, this corresponds to an annual nesting complement of around 180 and 80 females on the west and east coast respectively. The majority will probably be C. mydas with some L. olivacea and fewer Eretmochelys.

Trends in nesting numbers The species is said to have become rare by 1980 in Thailand (1980), and sea turtles in general have reportedly declined (Polunin, 1980; Piyakarnchana, 1985); however, little quantitative information is available. A particularly rapid decline in turtles nesting in Tarutao National Park, where numbers had been high, had occurred by 1980 (Ginsberg, 1981).

Nesting season Little specific information for Eretmochelys. At Tarutao National Park (west coast) Hawksbills are said to begin nesting after C. mydas at the same site have passed their peak, possibly in January (Ginsberg, 1981).

Foraging sites The species appears to be widely but sparsely distributed in Thai waters, but no information is available on favoured foraging sites.

EXPLOITATION

Commodity The principal sea turtle commodity exploited in Thailand is the eggs of all species, which are systematically collected. Turtle meat is widely, but not openly, consumed when it is available. There is evidence of turtle killing in 12 provinces. The Moken, sea nomads of the west coast, have traditionally hunted turtles (Polunin, 1975). E. imbricata is also extensively exploited for its shell (Ginsberg, 1981).

Hunting intensity Bain and Humphrey (1980) asserted that the level of turtle exploitation in Thailand was at an all-time high and was increasing. Egg collecting is theoretically carried out under Government control, and the rights to collect eggs are rented out to collectors, who are required to release hatchlings equivalent to a certain percentage of the eggs collected. The total number of eggs collected according to the Fishery Statistical Bulletins for the South China Sea Area (Veravat Hongskul in litt., 19 September 1986) was 94 934 in 1983 (see Table 201). Polunin (1975) reported that on intensively collected beaches probably not a single nest escaped collection, and that even on remote offshore islands, turtle eggs were heavily (illegally) harvested by fishermen. He calculated that the total harvest in Thailand was about 400 000 eggs, saying that even on rented beaches, the total harvest was usually 50% higher than that reported, allowing for local consumption by egg collectors (Table 199).

Table 199. Estimated annual egg harvests from different localities in Thailand from Polunin (1975). a = Official Statistics + 50%, to allow for local consumption by egg collectors; b = Verbal report + 50%, to allow for local consumption by egg collectors; c = Guess.

Locality	Egg nos.
Ko Khram	80 000 a
Ko Adang	80 000 b
Pha Nga	60 000 a
Phuket	10 000 a
Pattani	30 000 a
Ko Kra	10 000 c
Similan Is.	20 000 c
Sulin Is.	20 000 c
Ko Kut/Ko Chang	20 000 c
Other West Gulf	20 000 c
Other East Gulf	20 000 c
Other West Coast	20 000 c
Total	390 000

Hunting methods Egg collecting rights for specific beaches are usually rented out by the local government fishery departments to collectors for ten-year periods, but there is also considerable unregulated collection of eggs. Most of the adult turtles are caught incidentally in fishing trawls or seine nets, providing a significant supplement to the fishermen's income. The Moken use special harpoons to fish for turtles at sea, and also capture nesting females on land. In the Gulf of Thailand, bamboo-stake fish traps often catch turtles (Polunin, 1975).

Historical trends Historical data on the levels of egg harvest have been reviewed by Polunin and Nuitja (1982), who concluded that the harvest had declined since the 1950s. The most complete data are available for Pha Nga Province (Table 200), which show a significant (as tested by Spearman's Rank Correlation Co-efficient) decline in the decade preceding 1973 (Polunin and Nuitja, 1982). Another major egg collection site is Ko Khram Island, in the Gulf of Thailand, where average annual egg yields reported for the three-year periods 1955-57 and 1963-65 and the two-year period 1972-73 were respectively 171 402, 185 000 and 50 850. In 1987, 26 000 eggs were laid at Ko Khram (J. Mortimer in litt., 12 May 1988).

Official statistics for the reported egg harvests for the whole of Thailand, compiled by the South East Asia Fisheries Development Centre in their Fishery Statistical Bulletins for the South China Sea Area between 1978 and 1983 (Table 201) do not show any discernible trend, but it is not known how reliable these figures are. Polunin (1975) estimated that the reported figures should be increased by 50% to take account of the local consumption of eggs, and said that statistics were lacking for many areas.

Table 200. Reported egg yields from three districts in Pha Nga Province. Data for some years are lacking or incomplete (Polunin, 1975).

	Takuatung	Churaburi	Thai Muang	Total
1964	18 763	16 175	16 185	51 123
1965	17 080	24 073	14 616	55 769
1966	15 110	19 820	12 570	47 500
1967	3 995	18 781	20 574	43 350
1968	-	15 865	6 044	-
1969	-	9 074	1 583	-
1970	9 325	4 975	3 230	17 530
1971	9 005	-	-	-
1972	10 400	7 000	19 000	36 400
1973	11 065	19 034	13 090	43 189

Table 201. Reported egg harvests for the whole of Thailand, compiled from the Fishery Statistical Bulletins for the South China Sea Area, South East Asia Fisheries Development Centre (Veravat Hongskul in litt., 19 September 1986)

	Gulf of Thailand	Indian Ocean	Total
1978	35 664	34 500	70 164
1979	43 235	60 280	103 515
1980	33 234	251 524	284 758
1981	29 798	148 980	178 778
1982	61 097	96 300	157 397
1983	38 584	56 350	94 934

Domestic trade Turtle eggs are generally sold in the vicinity of the beach on which they were collected; however, some, particularly the eggs of D. coriacea, which are considered a luxury, are transported for sale in the city markets in Bangkok. In 1974, the eggs of C. mydas sold for Bht2.00 (US$0.10) each, and occasionally as much as Bht3.00, while those of E. imbricata and L. olivacea were valued at Bht1.50-1.80 each (Polunin, 1975). In 1985, in Pha Nga Province, L. olivacea eggs sold for Bht15 each and D. coriacea for Bht25 each (J. Mortimer in litt., 12 May 1988). The meat of a single large turtle was said to be worth about Bht1000 (US$50) in 1974, which was equivalent to about 30 times a labourer's daily wage. Stuffed turtles are occasionally sold, and fetched about Bht700-2000 each in 1974. Small E. imbricata were worth about Bht100 per inch (US$2 a cm) (Polunin, 1975).

International trade Thailand's Customs statistics report both imports and exports of raw tortoiseshell (Tables 202 and 204). Several other countries report importing tortoiseshell from Thailand (Table 203). On the basis of such Customs statistics, it has been inferred (Bain and Humphrey, 1980; Mack et al., 1982) that Thailand has been a major exporter of the shell of E. imbricata. However the fact that Japan has not reported any imports of bekko (shell of E. imbricata) from Thailand since 1973 suggests that much of the shell exported may have been of fresh-water turtle bones and shells which are widely used in oriental medicine. Hong Kong is known to import large quantities of this commodity. Similarly, most of the countries from which Thailand has reported importing raw tortoiseshell, mostly China and Laos (see Table 204), are not known to be major producers of E. imbricata shell, and indeed Laos has no seaboard. It is therefore probable that the imports were also mainly of freshwater turtle shell.

Table 202. Domestic exports of unworked tortoiseshell (kg) from Thailand to various countries of destination reported in Thailand Customs Statistics

Dest'n	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Belgium	0	0	0	0	0	0	0	0	0	0	0	0	5
China	0	0	0	0	0	0	0	0	0	2650	8100	0	0
France	0	0	0	0	0	0	0	0	0	0	36	0	0
H.Kong	6250	7672	9578	16859	28031	26990	7500	6500	2420	5870	15991	65977	53668
Japan	0	0	33	0	0	0	180	0	0	0	600	0	0
S'pore	0	0	0	0	5000	5628	0	0	0	0	0	8507	0
S.Korea	200	100	0	0	0	500	0	0	0	0	0	0	0
Taiwan	8050	6750	1000	7000	4910	20500	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0	440	0	0	0	0	0
Total	14500	14522	10611	23859	37941	53618	7680	6940	2420	8520	24691	70484	53709

Thailand acceded to CITES on 21 January 1983 and has never reported exporting any turtle products. However, the CITES Annual Reports of importing countries indicate a substantial tourist trade in leather goods made from turtle skins. A total of 31 leather items made from Cheloniidae skin and eight of C. mydas have been reported since 1981.

Table 203. Raw tortoiseshell imported from Thailand reported in the Customs statistics of importing countries. * all tortoiseshell imported to Japan was reported as "Other Tortoiseshell", i.e. not E. imbricata.

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
H. Kong	-	3986	859	11232	11959	20050	0	0	1578	7001	15184
Japan *	0	0	0	0	0	1550	1980	1200	0	0	0
S'pore	0	0	0	0	5011	5628	-	-	-	-	-
S. Korea	-	900	900	0	2200	520	1500	0	1000	0	1300
Taiwan	-	0	1500	7450	3920	29180	30	0	10000	0	0

Table 204. Domestic imports of unworked tortoiseshell to Thailand from various countries of origin reported in Thailand Customs Statistics

Origin	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Cambodia	135	0	0	0	0	0	0	0	0	0	0	0	0
China	0	0	0	1090	1060	1607	2269	1158	1201	1990	3000	2383	358
H. Kong	0	0	0	0	0	144	0	0	0	0	0	0	0
India	0	0	0	0	0	90	0	0	0	0	0	0	0
Indonesia	0	0	394	0	0	0	60	0	0	0	0	0	0
Laos	0	0	0	0	1171	781	615	0	0	2241	810	347	0
Maldives	0	0	200	0	0	0	0	0	0	0	0	0	0
S'pore	282	583	96	0	0	0	0	0	0	0	0	0	0
S. Korea	1117	1591	1782	148	0	0	0	0	0	0	0	0	0
Total	1534	2174	2472	1238	2231	2622	2944	1158	1201	4231	3810	2730	358

LEGISLATION

The Fisheries Act, B.E. 2490 (1975), (cited in Piyakarnchana, 1985).
Prohibits the collection or sale of marine turtle eggs, except with the permission of the authorities.

Ministerial Regulations, B.E. 2525, 26 August 1982.
Lists five species of sea turtles as totally protected.

On 19 November 1930, a law is said to have been introduced prohibiting the export of turtle shell without the permision of the Ministry of Commerce (J. Mortimer in litt., 12 May 1988).

RANCHING

Under the terms of the licences granted, the egg collectors are required to release hatchlings equivalent to a certain percentage (often 10%) of the number of eggs collected (Bain and Humphrey, 1980). There are heavy fines

imposed for failure to comply with these requirements: Bht15 000 in north-west Phuket, Bht5000 in south-west Phuket, Bht45 000 at Takuatung (Pha Nga), Bht33 000 at Thai Muang (Pha Nga), and Bht39 000 at Churaburi (Pha Nga). In Pattani, each concessionaire pays a deposit of Bht7500, which is forfeited if the hatchlings are not released. However, supervision of the release of hatchlings was said to be poor, and probably fewer than 20 000 were released annually between 1965 and 1974 (Polunin, 1975).

Under a programme begun in 1974, 50% of the eggs from certain beaches were removed for incubation at fishery stations. Most of the eggs were of L. olivacea, with some C. caretta, E. imbricata and a few C. mydas. Under this scheme, 1107 hatchlings were released in 1977, 4820 in 1978, 5213 in 1979, and 3000-4000 in 1980. Experiments with farming were said to be being carried out at Phuket (Bain and Humphrey, 1980), and there were small-scale rearing efforts at Sattahip and along the coast at Changwat (Polunin, 1975).

In Tarutao National Park, eggs are relocated from remote beaches to protected areas, to prevent poaching. The hatching percentage was said to be 80% for C. mydas and 60% for L. olivacea. Natural hatching rates are normally higher, and so attempts were being made to conceal the marks left by the nesting females to prevent poaching without the need to move the eggs. Early experiments looked promising (Ginsberg, 1981).

TOGO

No recent information available; Villiers (1958) records a vernacular name for C. mydas and E. imbricata, suggesting that both species occur in Togo; no information is available on nesting.

International trade Togo ratified CITES in 1978. The only records of trade in turtle products from Togo were in 1983, when Switzerland and the USA both reported importing single shells of "Cheloniidae" and E. imbricata respectively.

LEGISLATION

Ordinance No. 4, 1968
Export permit is required for all wild animals.

Ordinance No. 79/13, 17 April 1979. (Amendment of 1968 ordinance on wildlife protection and hunting in Togo).
Sea turtles are partially protected from possession and trade.

POPULATION: Chelonia mydas

Nesting sites The species nests at all three atolls comprising the Tokelau group: Atafu, Nukunonu and Fakaofo. Nesting in each case appears to be largely restricted to the seaward side of islets along the eastern perimeter of the atoll (these are generally the most windward and furthest from villages) (Balazs, 1982b). Much of the shoreline is composed of limestone and coral shingle; fine coral sand beaches suitable for nesting comprise perhaps 25% of the ocean-side coast.

Nesting numbers Based on interviews and beach surveys, Balazs (1982b) made the preliminary estimate that approximately 120 females nest annually: 20 on Atafu, 70 on Nukunonu, and 30 on Fakaofo.

Trends in nesting numbers Hirth (1971) cited a report that the number of sea turtles nesting in the Tokelau Islands was said to be rapidly decreasing; similarly Wodzicki (1972, cited in Balazs, 1982b) said that numbers "have lately been very low". A comparison of past and present harvest estimates (see below) indicates that the number of turtles caught has declined since the early decades of the century (Balazs, 1982b). Balazs (1982b) stresses that turtles can now be hunted at sea much more efficiently than in the past, because of the use of outboard motors and more sophisticated capture methods, and that despite this increased efficiency, fewer turtles can be caught; the inference is that populations have declined.

Nesting season The Green Turtle in Tokelau breeds mainly in September-November and adults are infrequently seen at other times of year (Balazs, 1982b).

Foraging sites Turtles, mainly immatures of 40-60 cm carapace length, may be seen foraging in the Tokelau lagoons and along the outer reef throughout the year. Adults are present mainly in the nesting season and presumably use the same feeding grounds at this time. Algae are said to be the main food source in Tokelau.

Migration The adult C. mydas population appears to be almost entirely migratory; Balazs (1982b) speculates that the Tokelau nesting turtles may forage in the coastal waters of Western Samoa, where the species occurs but does not nest.

POPULATION: Eretmochelys imbricata

The Hawksbill has been recorded at all three Tokelau atolls, but nesting is known only on Nukunonu, and there only rarely. Most E. imbricata seen are immatures and are suspected to be resident in the lagoon and outer reef areas (Balazs, 1982b). It is possible that this species has shared in the general decline suspected to have affected Tokelau sea turtles (Balazs, 1982b), but no specific information is available, and no indication that nesting numbers were ever greater in the past.

THREATS

Balazs (1982b) stated that the long-term decline in turtle nesting suggested by available evidence is probably mainly attributable to excess harvesting of eggs and turtles in Tokelau, and perhaps to harvesting on distant feeding grounds.

EXPLOITATION

Commodity Both C. mydas and E. imbricata (the latter, rarely caught) are eaten and are said to taste equally good. There is no record of turtle poisoning. Hawksbill shell was formerly used for fish hooks and for earrings, though neither practice continues. Sea turtles and their eggs are regarded as common property and are shared out amongst the villagers. All villagers are allowed to eat turtles, but there are various taboos concerning their capture and preparation (Balazs, 1982b). At Atafu, the Council of Elders has placed a ban on the taking of turtle eggs (Anon., 1985g).

Hunting intensity Balazs (1982b) reported that "in most cases" when turtle nesting tracks are found the eggs would be taken, although egg collection is now banned on two of the three atolls.

Hunting methods The traditional method of catching turtles is by diving to attach a rope to them. Iron hooks are increasingly being used for this purpose. Turtles are also turned on the nesting beach. When eggs are unearthed they are examined to determine, from the state of development, the date when the female is expected to return to nest. Some eggs are sometimes reburied to hatch a "pet" turtle. Pet turtles are not generally eaten (Balazs, 1982b).

Historical trends Balazs (1982b) considered that there were no traditional restraints on the capture of turtles, as were sometimes found on other Pacific islands, but that turtle hunting on remote islands was restricted by difficulty of access. The increased mobility allowed by aluminium boats with outboard motors, and more efficient harvesting methods, appear to have facilitated over-exploitation. Elderly local inhabitants reported to Balazs in October 1981 that 3-4 turtles could be caught daily in the early decades of the century, corresponding to 90-120 a season. Another informant reported that "at least" 20 could be caught each season in the 1930s. Macgregor (1937, cited in Balazs) reported that 80 turtles a year were caught in the 1920s. Even with the increased mobility, fewer turtles are now caught each year (Balazs, 1982b). Annual harvest in recent years has comprised around 45 adult turtles (both sexes); about 20 at Nukunonu, 10 at Fakaofo and 15 at Atafu (Balazs, 1982b).

International trade The Tokelau Islands are not party to CITES. CITES Annual Reports reveal no trade in sea turtle products involving Tokelau.

LEGISLATION

Collection of turtle eggs was prohibited on Atafu Atoll in the early 1970s (Balazs, 1982b). F. Toloa (in litt., 25 February 1987) reported that egg collection had also been banned on Nukunonu, and that similar measures were being discussed on Fakaofo.

POPULATION: Chelonia mydas

Nesting sites Nesting appears to be widespread in the Vava'u (northern) and Ha'apai (central) island groups, although extremely sparse (Braley, 1974). With the exception of Malinoa, (species uncertain), no nest sites are known at present in the Tongatapu group (Wilkinson, 1979).

Although local fishermen stated that nesting (by sea turtles in general) occurred on at least 27 islands in Ha'apai, a survey in November 1973-January 1974 (Braley, 1974) was able to confirm nesting only on around a quarter of these, and in all cases only single or very few nests were seen (those nests and turtles that were identified were all C. mydas). Similarly, nesting was noted on three of four islands visited in the Vava'u group, but the highest numbers found on any one were one fresh nest and four old nests. According to Wilkinson (1979), C. mydas nesting occurs on Nukufaia, Feto and Mango in the Ha'apai group, and may occur on other islands also used by E. imbricata.

Nesting numbers See preceding paragraph. All signs of nesting recorded by Braley (1974) were of single fresh nests or one or a very few older nests; the best nesting island (Fonuaika in the Ha'apai group) held only nine nests between one and three weeks old and two nests one or two days old. The species involved was not recorded, but all identified signs or turtles noted in the 1973-74 survey were C. mydas. The relative proportion of nesting by C. mydas and E. imbricata is not well-known, however.

Trends in nesting numbers On the basis of local reports received, and a comparison of field survey results in 1972, and 1973-74, Braley (1974) stated that the numbers of nesting turtles had decreased rapidly (and believed that turtles were likely to be extirpated in a decade unless protective measures were implemented). Nesting had ceased on a number of islands previously regarded as good turtle islands, and was critically low in Vava'u and Ha'apai generally (Braley, 1974). Hirth (1971a) cited information that foraging turtles in the Kauvai lagoon had declined in numbers to the extent that turtling was probably unprofitable.

Nesting season According to Wilkinson (1979), sea turtle nesting in the Vava'u group extends from October to January, with most nesting in December-January (species not stated).

Foraging sites Hirth (1971a) reported that C. mydas forage off Tongatapu, one of the best pastures being off Nuku'alofa (the capital) and east of the islands of Paloa, Alakipeau, Tufata and Atata. Turtles occur year round on these seagrass pastures, but particularly in November-March when the vegetation is most lush. No information is available on feeding areas elsewhere in Tonga.

POPULATION: Eretmochelys imbricata

Nesting sites Wilkinson (1979) reported, on the basis of a May 1973 fisheries survey, that the Hawksbill nests on 28 islands in the Ha'apai group, with probable nesting on another (and nesting by unspecified turtles on three inhabited islands). However, the November 1973-January 1974 survey reported by Braley (1974), with additional information from December 1971-January 1972, found almost no nesting in the Ha'apai group, and all identified turtles were C. mydas. According to Braley (1974), the Hawksbill

nested prior to 1974 on Kelefesia (where the last nest was said to be eight years before) and on Mangoiki (last nest two or three years before).

Nesting numbers Little information is available; the report by Braley (1974) implies that Hawksbill nesting (and by sea turtles generally) is at a very low level indeed, whereas Wilkinson (1979) implies that nesting is widespread without giving any indication of the numbers involved.

Trends in nesting numbers No specific information, but the species may well have shared in the general decline in nesting numbers reported by Braley (1974) and acknowledged by Wilkinson (1979).

Nesting season According to Wilkinson (1979), sea turtle nesting in the Vava'u group extends from October to January, with most nesting in December-January (species not stated).

THREATS

The decline in turtle numbers reported by Braley (1974) is attributed directly to over-exploitation of eggs and turtles, and the rapid decrease around Braley's time of writing mainly to the introduction of the speargun.

EXPLOITATION

Commodity The eggs and meat of turtles are eaten in Tonga. C. mydas was the species most commonly seen in the Government market (Wilkinson, 1979). Whole carapaces of all species are sold in tourist shops, and some Hawksbill shell is worked into jewellery by local craftsmen (Hirth, 1971a).

Hunting intensity The absolute intensity of turtle hunting in Tonga is not known, but a survey by Braley (1974) showed that it was widespread and heavy. On inhabited islands, it seems that the majority of nests are raided and that nesting females are caught. Egg collecting trips are also made to uninhabited islands at regular intervals, and Braley reported few undisturbed nests even during December and January when they were nominally protected. Hirth (1971a) reported that a turtle fishing boat with three crew would catch a maximum of 2-3 C. mydas during a day at Nuku'alofa.

Hunting methods Spearing is probably the most common method of catching turtles at sea, though nets are used, particularly in the Ha'apai group. Special turtle fences were used at least until the 1950s, but had largely been abandoned by 1970. Other capture methods include turning on the nesting beaches and capture by hand at sea after chasing the animal in a motor boat (Hirth, 1971a). Braley (1974) noted that the introduction of the speargun had greatly increased the efficiency of turtle hunting.

Historical trends No direct information, except that Braley (1974), as noted above, considered that the intensity had increased.

Domestic trade Hirth (1971a) reported that turtle eggs were all consumed locally and that none was found in the markets at Tongatapu. Similarly, most turtles were butchered locally, but those that did reach the market sold for 5-40 c a lb. Carapaces of C. mydas and C. caretta fetched $8-16 in the tourist shops and those of E. imbricata about $8-25.

International trade Tonga is not a Party to CITES, but CITES Annual Reports indicate that Tonga is the source of small quantities of turtle shell tourist products, a total of 33 items being reported as imports by the USA between 1980 and 1984.

Fijian Customs statistics report imports of small quantities of worked tortoiseshell from Tonga in 1971, 1972, 1976, 1977 and 1978.

RANCHING/HATCHERIES

A head-starting project for E. imbricata was operated at Sopu Marine Station briefly in the 1970s (Wilkinson, 1979). Fishermen at Pangaimotu Island were said to keep turtles in an enclosure on the beach, feeding them on seagrass which had washed up on the shore (Hirth, 1971a).

LEGISLATION

Turtle regulations in the Law of Tonga, revised edition 1967.

Turtles and their eggs are fully protected from 1 December to 31 January.
Turtle fences must be licensed and must be less than 450 feet (137 m) in width and length, and have a mesh size of greater than 1.5 inches (38 mm).
The use of poison (other than "aukava" prepared locally by traditional methods) and dynamite is prohibited.

Birds and Fish Preservation Act No. 24 (17 September 1974), amended 26 June 1975.

The capture of Leatherback Turtles is prohibited throughout the year.
All other species of turtle may not be caught between 1 November and 31 January.

POPULATION: Chelonia mydas

Nesting sites Information is limited. Green Turtles were reported to nest on the north and east coasts of Trinidad, with specific nesting beaches being identified at Mayaro, Matura, Matelot and Big Bay (Bacon, 1973) and Manzanilla Bay (Bacon, 1981). Nesting on Tobago was known to occur at Batteaux Bay and Grafton Estate (Bacon, 1981).

Nesting numbers No numerical data are available. Pritchard (1984) stated that nesting was occasional and probably less common than that of the Hawksbill. Carr et al., (1982) considered Green Turtle nesting density to be minimal and Bacon (1981) reported nesting to be occasional on both Trinidad and Tobago. When compared with the nesting concentrations in the Guianas (Pritchard 1969) the Trinidad and Tobago turtle populations were considered to be very small, though they were thought to be larger than those on most Caribbean islands (Bacon, 1973).

Nesting season Nesting records are sparse; in part using data from nearby populations, Bacon (1973) estimated the nesting season of C. mydas to be February-August.

Foraging sites Pritchard (1984) considered C. mydas to be moderately common in the waters of Trinidad and Tobago and Bacon (1981) reported frequent foraging by both adults and juveniles in the waters around Trinidad. Foraging in Trinidad was known to occur in the Gulf of Paria and on the north coast near Toco (Bacon, 1981), and at Grande Rivière Bay, Soldado Rock and Scotland Bay (Chu Cheong, 1984), Man o' War Bay, Buccoo Reef and Bon Accord Lagoon were identified as foraging sites at Tobago (Bacon, 1981).

Migration There appears to be an important migratory route along the northern coast of Trinidad and Tobago (Carr et al., 1982). A Green Turtle that had been tagged on the Tortuguero nesting beach (Costa Rica) was later captured in the Gulf of Paria on the west coast of Trinidad (Carr, et al., 1982).

POPULATION: Eretmochelys imbricata

Nesting sites Information is limited, but the species is known to nest on the north and east coasts of Trinidad and also on Tobago (Bacon, 1973). Nesting on Trinidad has been reported at Mayaro, Big Bay, San Souci, Matelot, Monos Island, Huevos Island and Chacachacare Island (Bacon, 1973); Maracas, Matura, and Manzanilla (Bacon, 1981); Brigand Hill (Carr et al., 1982); and Macqueripe Bay (Chu Cheong, 1984). The only nesting site so far identified on Tobago was at Bird of Paradise Bay (Bacon, 1973).

Nesting numbers Bullis (1984) inferred heavy to moderate nesting activity but this seems unlikely as only two confirmed Hawksbill nests were reported by Chu Cheong (1984). Bacon (1981) considered Hawksbill nesting on Trinidad to be rare. Carr et al., (1982) believed nesting density to be minimal. Pritchard (1984) concluded that the species nested rarely on beaches in eastern Trinidad, somewhat more frequently on the north coast beaches, and regularly, though not in aggregations, on the islands of the Boca del Dragon, especially on Chacachacare Island.

Nesting season Ingle and Smith (1949, cited in Bacon, 1973) gave the Hawksbill nesting season as June to August in Trinidad. However, using

other observations, Bacon (1973) gave the nesting season as May or June to September. According to Pritchard (1984a) an informant at Paria Beach, Trinidad, reported that Hawksbills nested there in small numbers from March to October.

Foraging sites Bacon (1981) reports frequent foraging by adult Hawksbills and gives Salybia Reef and the north coast near Toco as foraging sites in Trinidad, and Buccoo Reef, Man o' War Bay and Bon Accord Lagoon as major foraging sites in Tobago. Chu Cheong (1984) reports foraging in Trinidad at Macqueripe Bay, Grande Rivière Bay, Salibra, Salire Bay, Canari Poit and Soldado Rock.

EXPLOITATION

Commodity The sale of meat and eggs of all species and of shell from the Green and Hawksbill supplement the income of many fishermen for short periods of the year (Bacon, 1973). According to Pritchard (1984a), the Hawksbill was taken principally for the export of its shell. The Green Turtle was taken largely for its meat and Pritchard (1984a) considered the shell and leather to be of little commercial value or importance.

Hunting intensity Lee Lum (1985) reported that six depots were involved in catching sea turtles: Matelot, Toco, Grande Rivière, Mayaro, La Lune and Carenage. Nine other depots were investigated but fishermen claimed not to be involved in turtle hunting. Both E. imbricata and C. mydas were caught. Reported weekly catches at each of the turtle catching depots were 4-10 turtles, but on one occasion 50 turtles had been caught in one day in 1980 at Mayaro. At each of the depots, 1-4 people gained part-time earnings by fishing for turtles. Lee Lum (1985) also reported that fishermen from the south-western depots of Icacos, Fullerton and Cedros had stopped fishing for turtles owing to their scarcity.

Hunting methods Lee Lum (1985) reported the use of special turtle nets with a mesh size of 30 x 30 cm and extending 7-8 mesh (210 cm-240 cm) down into the water. They were approximately 30.5 m in length and could be joined to span longer areas. The nets were set in known feeding areas and checked every morning and evening. The majority of turtles were caught at night. Lee Lum (1985) also reported the use of harpoons at Grande Rivière, Toco and Carenage, and noted that at Toco, the Hawksbill was usually caught by harpoon.

Carr (1956, cited in Pritchard and Trebbau, 1984) reported fishermen dragging crude wooden decoys of female turtles behind their boats in order to attract male turtles.

Historical trends Ingle and Smith (1949, cited in Bacon, 1973) stated that 60 000 lb (27273 kg) of turtle meat were sold in 1947 at the Port of Spain market. About 10 000 lb of turtle meat were sold through the Carenage, Port of Spain and San Fernando markets in 1970 and most of this was Green Turtle and Hawksbill meat. This was only a small percentage of the meat sold as most of it did not pass through the larger markets where state records are kept (Bacon and Maliphant, 1971). Bacon (1970, cited in Bacon and Maliphant, 1971) estimated that in 1969 nearly all of the turtles nesting on the inhabited north coast beaches were killed each year. It was estimated that a catch of 15 turtles in one week in April 1972, held at St David Fishing Cooperative, would yield at least 1500 lbs (682 kg) of meat. According to Lee Lum (1985) it was apparent that turtle fishing

activity had declined since the enactment of the 1975 Protection of Turtle and Turtle Eggs Regulations. Fisheries Department figures were collected for 1969, 1970 and 1971 (Table 206) but Bacon (1973) cautions that these are far from complete.

Table 205. Total quantity of sea turtle meat sold. Fishery statistics data, 1969-1980, supplied by Fisheries Division, Ministry of Agriculture, lands and food production (Lee Lum, 1985).

	Trinidad		Tobago	
Year	Weight (kg)	Value TT$	Weight (kg)	Value TT$
1969	5327.9			
1970	3975.3	3,137	217.7	344
1971	6627.5	5,966	145.1	171
1972	6711.0	6,922	18.1	24
1973	3592.9	5,488	249.4	400
1974	5324.3	6,430	138.3	305
1975	6101.3	10,922	18.1	50
1976	4103.2	9,555		
1977	2569.8	8,277		
1978	3180.1	11,894		
1979	3836.0	14,476		
1980	7251.2	28,454		
Average	4883	10134	131	216

Table 206. Fisheries Department statistics on the quantity (in kg) of turtle meat sold at six beaches in Trinidad (Source: Bacon, 1973).

	1969	1970	1971
Carenage	5256	3950	4302
Gran Chemin	-	-	1424
Icacos	83		-
Matelot	-	10	-
Mayaro	-	-	895
San Fernando	-	23	20
TOTAL	5339	3983	6641

Domestic trade Most of the Green Turtle and Hawksbill meat is sold locally, being very popular in the coastal villages (Bacon and Maliphant, 1971). However, turtles caught by fishing boats at Cedros, or even as far south as Icacos, were frequently taken to markets in Port of Spain (Bacon 1973). The retail price of turtle meat was TT$3.00-TT$5.00 a lb (TT$6.60-TT$11.0 a kg) at the fishing depots investigated by Lee Lum (1985)

and up to TT$8.00 a lb (TT$17.6 a kg) at inland markets. The wholesale price was TT$1.00-TT$2.00 a lb (TT$2.20-TT$4.4 a kg), while turtle carapace sold for TT$5.00-TT$18.00 a lb at five of the depots. Lee Lum (1985) also reported that some carapace were bought and sent to Tobago. Pritchard (1984a) recorded that a considerable proportion of Hawksbill shell caught in Trinidad and Tobago waters was purchased, currently for TT$15 a lb (TT$33 a kg), by Hashim Mohamed of Toco.

The carapaces of juvenile Hawksbills were reported by Bacon (1973) to be sold to tourists for TT$30.00 or more, the smaller ones gaining the higher prices.

International trade A considerable quantity of Hawksbill shell from Trinidad is said to be exported to Japan by a dealer from St Lucia, Charles Fritz, who visits Trinidad (and other islands as far away as the Bahamas) approximately every three months purchasing shell for export (Pritchard, 1984a). Bacon and Maliphant (1971) considered there was little export of turtle shell from Trinidad. Lee Lum (1985) noted that some carapaces at the depots investigated were bought and sent to England.

Imports of E. imbricata shell reported in Japanese Customs statistics are given in Table 207. It should be noted that, as much of the Hawksbill shell from Trinidad is said to be exported to Japan via St Lucia, it may not be reported as coming from Trinidad in Japanese Customs statistics.

Trinidad and Tobago acceded to CITES on 19 January 1984. CITES Annual Reports between 1977 and 1984 record exports to the USA, UK and Denmark of a total of seven C. mydas shells, three E. imbricata shells and one Cheloniidae shell.

Table 207. Imports of bekko (E. imbricata shell) from Trinidad and Tobago, reported in Japanese Customs statistics (kg). No trade was reported in the other intervening years.

Year	1952	'53	'54	'55	'56	'57	'58	'59	'60	'61	'62	'63	'83	'84	'85	'86
kg	102	0	32	137	131	95	423	0	0	231	755	530	329	544	208	0

LEGISLATION

Protection of Turtle and Turtle Eggs Regulations 1975.

It is prohibited to take or possess female turtles which are in the sea within any reef or within 1000 yards from the high water mark of the foreshore when there is no reef.
It is prohibited to purchase, sell or possess any turtle eggs.
It is prohibited to take, possess, purchase or sell any turtle or turtle meat from 1 March to 30 September.

The Fisheries Act 1916.

The use of poison or explosives to kill or capture fish (including sea turtles) is prohibited.

POPULATION: Chelonia mydas

Nesting sites Nesting is restricted to the Mediterranean coast. According to Geldiay et al. (1982: p. 429, Fig. 3) some nesting takes place along central and eastern parts of Antalya Bay. Specific locations include Belek beach (40 km in extent, at 36°50'N, 30°58'E), Side (30 km, at 36°51'N, 31°28'E) and Alanya (12 km, at 36°36'N, 32°05'E). No Green nesting has been found west of Belek, and Alanya was the eastern-most site reported in the paper cited (apparently based largely on WWF/IUCN Project 1419, 1978-1980). Subsequent studies in 1980-1982 (Geldiay, 1984: p. 72, Fig. 9) revealed no nesting at Belek or Side, some nesting near Alanya, but more important nesting at Mersin, Tuzla, Karatas and Yumurtalik, all in the extreme east, south of Adana. Preliminary data from the 1988 season suggest that C. mydas nesting in Turkey is virtually restricted to this latter stretch of coast, where most nests were in the region of Kazanli and Akyatan (Kasparek, pers. comm.).

Nesting numbers According to Geldiay (1984: p. 72, Fig. 9) there appear to be 1-6 nests per kilometre per day of the nesting season at Alanya; fewer than one per km day at a site a little to the east of Alanya; and more than six nests per km day at each of the four sites: Mersin, Tuzla, Karatas and Yumurtalik. A precise figure for the length of all these beaches is not available, but if the data are reliable (and details of the surveys on which they are presumably based are not available), there could be in the region of 1000 females nesting annually. This would make Turkey the most important C. mydas nesting area in the Mediterranean. Preliminary data from surveys carried out in 1988 (Kasparek, pers. comm.) indicate that some 300 clutches were laid along the Mersin-Yumurtalik coast between late May and mid-July. If this rate, equivalent to about six nests per night, was maintained for the entire season, the 1988 nesting contingent may have been composed of, at most, some 200-250 females. This nesting population, even though small by world standards, is still by far the largest Green Turtle colony known in the Mediterranean.

Trends in nesting numbers No precise information on past population size is available, but numbers appear to have been relatively high (Baran, 1987). According to Baran and Sella (1982) turtle populations in the eastern Mediterranean, specifically including turtles nesting in south-east Turkey, have been very severely depleted by over-exploitation, and are near to extinction. While the population studied in 1980-1982 by Geldiay seems to have been already depleted greatly in comparison with 1950s-1960s levels, the preliminary 1988 data suggest a further marked decline (although possibly 1988 was a poor season for nesting). This last important Green Turtle population in the Mediterranean requires urgent protection and further monitoring. See "EXPLOITATION - Historical trends" below.

Nesting season Nesting by Loggerhead Caretta caretta and Green Turtles occurs between early May and early September (Geldiay et al., 1982); there are no data relating specifically to the level of Green Turtle nesting within this period.

Foraging sites Little detailed information is available; the species has been recorded in Turkish waters in the Aegean Sea, Sea of Marmara and Black Sea, in addition to the Mediterranean. Geldiay (1984) reported that good numbers, including immatures, are present along the Adana coast throughout the year, and suggested that the Turkish nesting population is resident.

Migration In the absence of tag-return data, no specific information is available. Sella (1982) reported evidence from fishermen who operated in the eastern Mediterranean between World War I and II, suggesting a northward migration along the Levant, possibly toward nest sites in Turkey If this was the case, then Turkish waters may have held a resident and a migratory population of Green Turtles.

POPULATION: Eretmochelys imbricata

No Hawksbill nesting has been recorded on Turkish territory. There appear to be no specific records of the species occurring in Turkish waters, and records for the Mediterranean as a whole are very sparse (there are no nesting records).

EXPLOITATION

Commodity In the past there has been an extensive fishery for turtles for the export of meat (see below), but there is apparently little indigenous consumption of meat, although medicinal uses are reported. There is a widespread belief that fresh turtle blood cures asthma and that the meat can be used for the treatment of haemorrhoids. There are occasional reports that when the blood of Caretta caretta has been used for medicinal reasons that the rest of carcase is sometimes discarded (Geldiay, 1978).

Hunting intensity Sella (1982) implies that there is little commercial exploitation at present, due at least in part to the depletion of regional stocks.

Hunting methods Although Sella (1982) reported that turtles were taken at sea, Baran (1987) stated that females were collected on the beach near Iskenderun, often before they had nested.

Historical trends A turtle fishery existed in the Mersin-Adana area of south-east Turkey in the 1950s and 1960s. By the late 1960s a number of companies were involved in buying turtles from fishermen working off Mersin; most turtles were processed at an abbatoir at Iskenderun, the entire production of which was exported to Europe. In the main hunting season (April-June) 200 turtles or more, mostly C. mydas, were processed daily; up to 15 000 turtles were reportedly taken from the Mersin area between 1952 and 1965. Most of the turtles weighed 120-150 kg, although animals as small as 15 kg were also thought to have been processed (Sella, 1982). As turtle stocks around Mersin became depleted the focus of fishing activity shifted eastward to the area south of Adana. Reportedly 100 Green Turtles or more were being caught daily in this area in May 1965, and Hiersch (cited in Sella, 1982) reported in 1972 that around 1200 turtles were being caught off Yumurtalik (south-east of Adana) each season. Geldiay et al. (1982) quoted fisheries statistics which showed that there was a sudden decline in the reported catch of turtles, from 286 505 kg in 1968 to 52 355 kg in 1969. It was not known whether this was attributable to a decline in the abundance of turtles or to economic factors. According to Mendelssohn (1983) (and it is not clear whether this refers to the same fishery) an Israeli set up a turtle soup production plant in the region in the 1960s, and "within 20 years, virtually annihilated the sea turtle population in the region".

International trade Apart from the export trade in turtle meat to Europe cited above, the only evidence of a continuing international trade in turtle

products is in CITES Annual Reports. In 1984, Italy reported importing 16 belts and 125 skins from Turkey, which were said to have originated in the Cayman Islands.

LEGISLATION

Fisheries regulations, Official Gazette, 28 February 1986.
The capture of sea turtles is completely prohibited.

POPULATION: *Chelonia mydas*

Nesting sites See Table 208.

Nesting numbers Garland (*in litt.*, 7 October 1986) reported nesting Green Turtles to be moderately abundant. Fletemeyer (1984b) estimated the population of nesting females to be 75 ± 30 in 1982. Carr *et al.* (1982) and Bacon (1981) considered nesting to be rare.

Trends in nesting numbers Garland (*in litt.*, 7 October 1986) considered the nesting population to be decreasing.

Nesting season Fletemeyer (1984b) observed nesting between April and August.

Foraging sites Fletemeyer (1984b) noted foraging at Big Ambergris Cay, Little Ambergris Cay, Fish Cay, Bottle Creek, Highas Cay, Grand Turk, Gibbs Cay, Cotton Cay, East Cay, Salt Cay, Grand Caicos, North Caicos and Ocean Hole. Carr *et al.* (1982) noted that young Green Turtles were abundant in mangrove creeks along the southern shores of the Caicos Islands. According to Bacon (1981), foraging by adults was occasional and by juveniles frequent.

POPULATION: *Eretemochelys imbricata*

Nesting sites See Table 208.

Nesting numbers Garland (*in litt.*, 7 October 1986) reported nesting in medium abundance. Fletemeyer (1984b) estimated the population of nesting females to be 200 ± 75 in 1982. Carr *et al.* 1982 reported no concentrated nesting by any species in the Caicos Islands, but noted that Hawksbills were the most abundant nesters. Bacon (1981) considered Hawksbill nesting to be frequent.

Trends in nesting numbers Garland (*in litt.*, 7 October 1986) considered the nesting population to be decreasing.

Nesting season Nesting reported by Fletemeyer (1984b) occurred April-August.

Foraging sites Foraging was reported at Big Ambergris Cay, Little Ambergris Cay, Fish Cay, Highas Cay, Grand Turk, Gibbs Cay, Cotton Cay, East Cay, Salt Cay, Grand Caicos and North Caicos. Bacon (1981) noted frequent foraging by both adults and juveniles.

EXPLOITATION

Commodity The major commodities were meat, eggs and shell products from both Green Turtles and Hawksbills (Garland, *in litt.*, 7 October 1986).

Hunting intensity Fletemeyer (1984b) reported the capture in 1982 of 800 (4000 kg) Hawksbills. The weights given for these catches would indicate that they consisted predominantly of juveniles of both species. Annual subsistence exploitation was estimated at 8000-10 000 eggs, 20-30 nesting females and 200-400 turtles caught at sea. The number of people dependent on fishing for turtles was estimated as 80 ± 10 in 1982. Cockburn Town (Grand Turk), Bottle Creek (North Caicos), South Caicos, Salt Cay, Conch

Table 208. Nesting sites of C. mydas and E. imbricata in the Turks and Caicos Islands (source: Fletemeyer, 1984b); + = nesting reported, ? = unconfirmed reports, - = no nesting reported.

LOCATION	SPECIES NESTING	
	C. mydas	E. imbricata
Grand Turk Island	?	+
Highas Cay	+	+
Horse Cay	-	?
Little Ambergris Cay	?	?
Long Cay (East Caicos)	-	?
North Caicos Island	?	+
Parrot Cay	?	+
Pine Cay	+	+
Providenciales	?	+
Salt Cay	?	?
Big Ambergris Cay	?	+
Big Sand Cay	-	+
Bush Cay	-	?
Cotton Cay	-	?
East Caicos Island	+	+
East Cay	-	+
Fish Cay	?	+
French Cay	+	+
Gibb Cay	?	?
Grand Caicos Island	+	+
Sand Bora Cay	?	?
Shot Cay	?	+
South Caicos Island	?	+
Stubbs Cay	-	+
Water Cay	?	+
West Caicos Island	+	+
West Sand Spit	+	?
White Cay	-	+

Bay, Kew, Whitby and Lorimers were noted as landing sites for turtles and turtle products. Carr et al. (1982) considered exploitation of sea turtles in the Caicos Islands to be minimal.

Hunting methods Fletemeyer (1984b) reported the use of nets and the capture of turtles by chasing them down in boats. Carr et al. (1982) noted that there was no apparent commercial turtle fishery and that turtles were taken incidental to lobster and conch fishing.

Historical trends Fletemeyer (1984b) discussed the history of sea turtle exploitation in the Turks and Caicos Islands. There are reports from as early as the Spanish exploration until the late 19th century of ships stopping to replenish their stores with sea turtles from the Turks and Caicos Islands. In 1906 the Turks exported US$3538 worth of Hawksbill shell (Sadler, 1972: p. 37, cited in Fletemeyer, 1984b). The local turtle industry apparently reached its peak around 1907, and in 1909 the Caicos Development Company leased Chalk Sound for the raising and canning of

turtles. Although the sea turtle industry was quite large during this period, it gradually declined until it had virtually disappeared by 1950. A presumed decline in the turtle populations and a reduced demand for turtle products were thought to be responsible for the disappearance of the industry.

Domestic trade Garland (in litt., 7 October 1986) reported domestic trade in turtle meat, eggs and shell products. No tourist trade in tortoiseshell jewellery and curios was noted by Carr et al. (1982), although it was thought that such trade may have occurred at Providenciales, the main tourist centre. Fletemeyer (1984b), reported that nearly all turtles were consumed locally, although they were found sporadically in markets all year round. Local prices in 1982 were: live weight, US$1.00 a lb (US$2.20 a kg); meat, US$1.90-2.50 a lb (US$4.18-5.50 a kg); shell, US$10.00-20.00 a lb (US$22.00-44.00 a kg); and eggs, US$1.00 for 50 (Fletemeyer 1984b). The total annual income derived from turtle fishing was estimated to be US$12 000-18 000 (Fletemeyer, 1984b).

International trade Japanese imports of bekko from the Turks and Caicos (and Cayman) Islands are given in Table 209. There are no report of Japanese imports of bekko in years other than those given in Table 209. CITES annual reports for the period 1977-1985 record the import to the UK from the Turks and Caicos Islands of two shells of E. imbricata in 1979. The Turks and Caicos Islands are not party to CITES. Carr et al. (1982) reported some trade of tortoiseshell with Haitian buyers, but noted that the volume of this trade was insignificant.

Table 167. Japanese imports of bekko from the Turks and Caicos (and Cayman) Islands, 1963-1971 reported in Japanese Customs Statistics.

1963	1964	1965	1966	1967	1968	1969	1970	1971
181	195	306	621	550	151	334	149	85

LEGISLATION

Fisheries Protection Regulations 1976, Cap. 98, 12 July 1976.

A licence is required for the commercial fishing and sale of all marine products (including sea turtles). Subsistence fishing is excluded. The use of explosives, poison and scuba diving equipment is prohibited when taking turtles.

The taking of turtles on beaches above low water mark is prohibited as well as the possession of and trade in laid turtle eggs.

Minimum size limits (neck scales to tail piece) are set for the taking of C. mydas (15") and E. imbricata (17").

Fisheries Protection (Amendment) Regulations 1982, 28 July 1982.

It is illegal for a commercial fisherman to "shelter" a "non-belonger" who is carrying on commercial fishing operations.

POPULATION: Chelonia mydas

Nesting sites The Green Turtle is reportedly the most common sea turtle in Tuvalu, and the turtles nesting on Funafuti atoll and other unspecified islands in the group may be presumed to be mainly this species (Pita, 1979d). No detailed information is available.

Nesting numbers No information is available; there is no indication that large numbers nest. Some 20-30 turtles monthly are caught by fishermen on three of the outer islands; it is not clear whether there are nesting or foraging turtles (nor is it clear whether the catch figure applies to each island or to all collectively; the latter appears to be the case).

Foraging sites According to Pita (1979d), C. mydas is often seen feeding on "weed" in lagoon shallows in Tuvalu atolls, and is also seen near reefs on the seaward perimeter; no data are available on sites of particular importance.

POPULATION: Eretmochelys imbricata

Pita (1979d) reported that the Hawksbill is very rare in Tuvalu, and often of small size. It is seen feeding on molluscs and other "small animals" in reef areas. No information is available on nesting; it is seemingly very sporadic.

THREATS

Balazs (1982c) cited reports that a tropical cyclone in 1972 deposited an 18 km-long rampart of coral rubble along the south-east outer reef of Funafuti and suggested that the impact on nesting turtles was likely to be substantial. See "Historical trends" in Exploitation, below.

EXPLOITATION

Commodity Turtle meat and eggs have long been a favoured food in Tuvalu, and have featured in ceremonial feasts. Consumption of turtle meat in the capital has declined, but they are still an important food item in the outlying islands. The shell [presumably of E. imbricata] was used for making fishing "lures" [= hooks?] (Pita, 1979d).

Hunting intensity Turtles are actively hunted in the outer islands, and every turtle seen in the lagoons or coming ashore to nest is usually captured. About 20-30 are captured a month. Some turtle hunting takes place around Funafuti, and Pita (1979d) reported that at times people "even collect all the eggs laid".

Hunting methods Traditional hunting methods include the use of special nets and diving from canoes. Turtles were also turned on the nesting beaches. Spearing turtles is a growing practice on Funafuti. When eggs were collected and brought back to the village, there is said to have been a custom of burying some in the beach to allow them to hatch (Pita, 1979d).

Historical trends Although turtles were an "exceptionally favoured" food in pre European times, the availability of refrigeration facilities and imported foods, particularly in the capital Funafuti, has greatly reduced the use of turtle meat. However, in the outer islands it appears that all

turtles seen at sea or on the nest beach are taken wherever possible. The Tuvalu Fisheries Division regards this exploitation as likely to result in serious depletion of stocks (Pita, 1979d).

International trade Tuvalu is not a Party to CITES. CITES Annual Reports contain no record of any trade in turtles involving Tuvalu. Fijian Customs statistics (q.v.) indicate the import of some worked tortoiseshell from Tuvalu in 1984 and 1985.

LEGISLATION

Wildlife Conservation. Cap. 47, 29 May 1975.
Capture of turtles on land is prohibited except under licence.
Possession of illegally acquired turtle or turtle egg is prohibited.

Fisheries Ordinance, Cap. 45, 1 July 1978.
Enables closed seasons or closed fishing areas to be declared.
Fishing with explosives or poisons is prohibited.
Prohibits fishing by foreign vessels except under permit.

RANCHING/HATCHERIES

Pita (1979d) reported that the inhabitants of Niulakita, the most southerly and isolated island, used to "culture" turtles in two ponds for use in traditional feasts. It is not known whether this refers to any more than simply holding turtles until they were needed for eating.

UNITED ARAB EMIRATES

POPULATION

Very little information is available. Green Turtles are quite frequently recorded in UAE waters, but singly or in small numbers (Brown, 1984). Turtles, probably Greens or Hawksbills, still nest on certain offshore islands (unspecified), apparently in small numbers. About 40 nests or possible nests were counted in 1984, all within the period 10 April-28 May. Ross (in litt., 29 December 1986) specified nesting by a small population (taxon unknown) on offshore islands of Dubai. Turtles nested on Das until at least 1980, when turtles could be seen ashore early on summer mornings.

THREATS

Coastal development and exploitation are thought to be contributing to a general decline in turtle numbers. The port of Jebel Ali was built on a C. mydas nesting area (Brown, 1983). The turtle population on islands near Dubai is reportedly seriously affected by fishermen taking eggs (Ross in litt., 29 December 1986).

EXPLOITATION

Commodity Green Turtles are exploited mainly for eggs (Brown, 1984), although some meat is evidently consumed (Ross and Barwani, 1982).

Hunting intensity The collection of eggs was said to be seriously affecting a small nesting population of either C. mydas or E. imbricata on the islands off Dubai (J.P. Ross in litt., 29 December 1986). Brown (1984) reported that nests on offshore islands were "regularly robbed by fishermen", and that this was probably contributing to a population decline.

Hunting methods Brown (1984) described finding a live Green Turtle upside down on a beach near Jazirat Badiyah. Small turtles are occasionally caught, probably accidentally, in drift nets (Brown, 1984).

Domestic trade Green Turtles, originating in Oman, were reported to be sold in the fish market in Abu Dhabi at approximately US$6 a kg (Ross and Barwani, 1982).

International trade The only evidence of international trade is the import of about 100 C. mydas a year overland in small trucks from Oman (Ross and Barwani, 1982).

LEGISLATION

There is no information on any legislation protecting turtles in the country. The UAE acceded to CITES on 1 July 1975 but withdrew from the Convention in 1988. It has never submitted an Annual Report, and is believed not to have enacted legislation to implement the Convention.

RANCHING

There were apparently plans for a sea turtle hatchery at Dubai Creek, but these have not been implemented, and it is thought that the area may be unsuitable (J.P. Ross in litt., 29 December 1986).

POPULATION: Chelonia mydas

Nesting sites Known annual nesting in continental USA is essentially limited to several sites along the south-east coast of Florida, from Brevard County southward (Anon., 1980c; Dodd, 1982; Conley and Hoffman, 1986). Florida sites include, in north-south order: Merritt Island, Sebastian Inlet, Hutchinson Island, Hope Sound National Wildlife Refuge, Highland Beach, Hillsboro Beach, John U. Lloyd State Park and Loggerhead Key (Dodd, 1982). Other sites are noted by Conley and Hoffman (1986). There are also records from North Carolina (Camp Lejeune) and Georgia (Jekyll Island) (Dodd, 1982). Nesting figures provided by Conley and Hoffman (1986) indicate that Hutchinson Island is by far the most important nesting site, followed by beaches in Broward County, with lesser numbers at Boca Raton Public Beach, Hobe Sound National Wildlife Refuge and Sebastian Inlet State Recreation Area.

Nesting numbers According to Berry et al. (1984) the total annual nesting number in continental USA, averaged over the years 1977-1982, is around 182. An extensive monitoring programme initiated in 1979 by the Florida Department of National Resources now covers a very substantial proportion of the state's nesting habitat. Selected data from this programme (reported by Conley and Hoffman, 1986) are presented in Tables 210 and 211.

Trends in nesting numbers Dodd (1982) concluded that "in spite of the spurt of development along much of the south-east Florida coast, there can be little doubt that there are more Green Turtles reported nesting now than there were 20 years ago". Similarly, Conley and Hoffman (1986) note an increase in reported nesting in 1982 and 1983 (Tables 210, 211), followed by a fall, and a record rise in 1985. These authors attribute a significant proportion of the increase in reported nesting to increased survey activity, and note the great variability between years, but are cautiously optimistic that the actual nesting population is increasing.

Dodd (1982) stated that there can be little doubt that the foraging population was once "appreciably larger" than at present, and this is substantiated by the past existence of turtle fisheries in eastern Florida and the Gulf; however, there is very little direct evidence of the past extent of nesting in south-east USA and it may be that the large number of turtles that foraged in the region nested elsewhere.

Table 210. Reported nesting activity by C. mydas in Florida 1979-1985 (data from Conley and Hoffman, 1986).

Year	Nests	Nests per km
1979	59	0.5
1980	316	1.7
1981	89	0.4
1982	216	1.6
1983	273	1.6
1984	172	0.8
1985	746	3.4

Table 211. Number of C. mydas nests per year at beaches surveyed consistently since 1981 (data from Conley and Hoffman, 1986).

Year	1981	1982	1983	1984	1985
Nests	55	134	153	94	211

Nesting season Most nesting by C. mydas in Florida is recorded between June and September (Bjorndal, Meylan and Turner, 1983).

Foraging sites The species uses coastal areas and lagoon systems in south and eastern Florida, including the Keys, Indian River and Mosquito Lagoon, as developmental and foraging habitat (Mendonca, 1981; Dodd, 1982).

Migration One C. mydas tagged at Cape Canaveral was caught at sea in Anguilla five years later (Meylan, 1983). No further information.

POPULATION: Eretmochelys imbricata

Berry et al. (1984) record isolated Hawksbill nests at Northern Longboat Key and Soldier Key (both in eastern Florida), and estimate the annual average nesting number as two. Nesting is also recorded near Juno, Palm Beach County. Lund (1985) reported on one individual female that nested on Jupiter Island in 1974, 1977 and 1979 (the two 1974 nests being fewer than 100 m apart), and cited another nest record from Canaveral National Seashore. Lund (1985), however, stated that Hawksbills are much more common in eastern Florida coastal waters than is generally believed, and cited information from N. Rouse that she had sighted Hawksbills on 60 occasions in 1978, 84 in 1979 and 153 in 1980, while diving on Palm Beach reefs; these sightings comprised mostly repeat records of sub-adults but a few of adult-size individuals. Stray individuals have been recorded as far north along the Atlantic coast as Virginia and Massachusetts and Mexico (Witzell, 1983).

THREATS

Threats include heavy nest pollution (particularly by racoons Procyon lotor), incidental catch by shrimp trawlers, various forms of beach disturbance and development (which can entail disorientation of turtles by lighting), and beach erosion (Dodd, 1982).

EXPLOITATION

Commodity Turtle meat has been popular in the USA since the last century, particularly for the manufacture of soup, but Cato et al. (1978) concluded that the demand for turtle products had declined before their capture and import had become illegal under the Endangered Species Act. There has also been a demand for luxury items made from E. imbricata shell.

Hunting intensity Since the listing of all sea turtles as endangered or threatened under the Endangered Species Act in 1978 (see below), the hunting of local turtle populations has been very limited.

Historical trends Florida was the centre of turtle exploitation in the USA, the trade peaking at the end of the 19th century at about 280 t. Landings declined in the 20th century, but the majority were thought to have been turtles caught mainly in Caribbean and Central American countries. Other states to have reported landings of turtles were Georgia, North Carolina, Texas, Mississippi, Virginia and Louisiana, but only in the last two did landings continue after 1925 (Cato et al., 1978).

Domestic trade Cato et al. (1978) described the US domestic market for turtle products at great length. They analysed the price of turtle products in relation to the volume of trade and concluded that the price was elastic, indicating that price increases would cause more than a proportionate decrease in demand.

International trade The USA continued to provide one of the world's main markets for imported turtle products long after its exploitation of indigenous turtles had declined. The imposition of imports controls since 1979 is thought to have effectively curbed most commercial imports and turtle products are the category of wildlife products most commonly confiscated by Customs from returning tourists. The USA ratified CITES on 14 January 1974, and USA CITES reports imports constitute the bulk of all the reports of international movements of turtle products contained in the CITES database. The great majority were imports of small quantities of personal items and curios. Prior to 1982 they were mostly reported as personal imports, and after that date they were mostly reported as seized illegal imports. The numbers of different imports reported are shown in Table 212. The most significant import reported in recent years was of 6 t of Cheloniidae meat imported for commercial purposes in 1984 from an unknown source.

Table 212. Numbers of imports of products of Cheloniidae, C. mydas and E. imbricata to the USA recorded in CITES Annual Reports. Most of these imports constituted several specimens.

	1980	1981	1982	1983	1984
Cheloniidae	42	45	42	108	83
C. mydas	63	116	82	124	64
E. imbricata	69	132	71	111	70

LEGISLATION

Endangered Species Act, 28 December 1973.

For endangered or threatened wildlife, it is illegal to:

1. Import or export.
2. Deliver, receive or transport in interstate or foreign commerce.
3. Sell or offer for sale in interstate or foreign commerce.
4. "Take", i.e. to harm, harass, pursue, hunt, shoot, wound, trap, kill, capture or collect, or attempt to do so.
5. Possess or transport any illegally taken wildlife.

Permits to take endangered wildlife may only be granted for scientific research or to enhance the survival of the species. Permits to take threatened wildlife may be granted for these reasons and also for educational or exhibition purposes.

The list below is the version contained in the code of Federal Regulations, 1984, Vol. 50, paragraph 17.11; it is up-to-date to August 1984. Dates when listed are given in brackets.

Endangered:

E. imbricata	(2 June 1973)
L. kempii	(2 December 1970)
D. coriacea	(2 June 1970)
C. mydas	Breeding colony populations in Florida and on the Pacific coast of Mexico (13 October 1970; 28 July 1978)
L. olivacea	Breeding colony populations on the Pacific coast of Mexico (28 July 1978)

Threatened:

C. caretta	(28 July 1978)
C. mydas	All other populations (13 October 1970; 28 July 1978)
L. olivacea	All other populations. (28 July 1978)

Endangered Fish or Wildlife, 27 November 1974.

The National Marine Fisheries Service has sole jurisdiction while turtles are in the water.

The U.S. Fish and Wildlife Service has sole jurisdiction while turtles are on land.

Designation of Critical Habitat for Fish and Wildlife Species. 22 September 1977.

All Federal Agencies must ensure that actions authorised, funded or carried out by them do not result in the Destruction or adverse modification of habitats of E. imbricata and D. coriacea.

JARVIS ISLAND

The island is uninhabited, but residents in 1935 reported that a few C. mydas bred along the west coast (Balazs, 1982c). Jarvis Island, including 14 744 ha of the surrounding sea, has been declared a National Wildlife Refuge.

JOHNSTON ATOLL

Green Turtles forage in the waters around Johnston Atoll, but nesting has never been confirmed. Tracks and diggings have been observed at Sand Island, though it was not ascertained whether eggs were laid. Out of a total of 71 turtles captured during two months of survey, 14 were mature adults. The provenance of the turtles foraging around the island is not known as no tagged turtle has ever been found. There is no evidence of any commercial exploitation of turtles ever having taken place. Between 1967 and 1976, a total of about 60 were captured and eaten by the military personnel on the island. Since 1976, the island has been declared a National Wildlife Refuge and all capture of turtles has been prohibited (Balazs, 1985).

HOWLAND AND BAKER REEFS

Both islands are now uninhabited, but residents in 1935 reported that turtles were abundant around Howland (Balazs, 1982c). C. mydas is said to have been observed inshore around Baker (IUCN, 1985). Feral cats inhabit both islands and might prey on hatchlings if nesting occurs. The islands were declared National Wildlife Refuges in 1974 (Balazs, 1982c). The reserves extend to cover 11 800 and 11 459 ha of sea around the two islands respectively.

PALMYRA ISLAND

Palmyra has a small resident human population manning the copra plantation. Green Turtles are regularly observed foraging around the island, but nesting has never been recorded (Balazs, 1982c).

WAKE ISLAND

Wake Island supports a USA Air Force base. Turtles have never been recorded nesting but immature and adult C. mydas are regularly observed foraging in and around the atoll (Balazs, 1982c).

International trade The US Pacific Islands are covered by the USA's ratification of CITES. CITES Annual Reports do not distinguish between these Pacific islands and the rest of the Trust Territory.

POPULATION: Chelonia mydas

Nesting sites Green Turtles have historically nested on St Thomas, St John, St Croix and Buck Island (Rainey, 1976 cited in Small, 1982). They were believed to have nested on St Thomas and St John into the mid-1960s (Small, 1980-82) and on Buck Island into the late 1970s (Towle et al., 1978, cited in Small, 1982). Boulon (1984) identified present day nesting sites at Buck Island and possible nesting at Shoy's Beach, Knight Bay, Grapetree Bay, Turner Hole, Rod Bay, Robin Bay, Manchioneel Bay, Manning's Bay, Sandy Point, La Grange, Maroon Hole, Davis Bay and Salt River (west); all on St Croix or its offshore cays.

Nesting numbers Nesting was considered to be of low abundance by Boulon (in litt., 9 February 1986) and to be occasional by Bacon (1981) and Carr et al. (1982). Staff at the Buck Island Reef National Monument believed that two or three Green Turtle nests occurred there each season (Small, 1982).

Trends in nesting numbers Schmidt (1916, cited in Boulon, unpublished) noted that turtle populations were drastically diminished due to "wanton destruction" of eggs and turtles. Boulon (unpublished) considered that high harvest rates of adult Green Turtles in the past (both in the water and on beaches, and heavy egg collection) may have eliminated most of the Virgin Island nesting population. Discussions with local fishermen and boaters suggested that turtle populations had steadily increased since 1973 when the Endangered Species Act came into effect (Boulon, unpublished). These do not, however, necessarily include the nesting population of Green Turtles.

Nesting season Nesting reported by Boulon (1984) occurred May-October.

Foraging sites Feeding sites were identified at Francis Bay, Maho Bay, Caheel Bay and Hawksnest Bay on St John; and at Magen's Bay, Red Hook, Thatch Cay, Little St James Island and Smith Bay on St Thomas (Boulon, 1984). Bacon (1981) reported foraging at Buck Island Reef. Carr et al. (1982) noted that coral reef and seagrass habitats were widespread in the Virgin Islands, with seagrass being particularly abundant near St John; Green Turtles were reportedly found throughout the area.

Migration Boulon (unpublished) suggested that, as the vast majority of Green Turtles in the Virgin Islands were sub-adult, the population may be using the US Virgin Islands as feeding pastures and migrating elsewhere to breed.

POPULATION: Eretmochelys imbricata

Nesting sites Boulon (1984) and Bacon (1981) reported nesting on numerous beaches on St Croix, St Thomas and St John. Carr et al. (1982) reported nesting throughout the US Virgin Islands.

Nesting numbers Boulon (1984) estimated the population of nesting females on St John and Buck Island in the years 1980, 1981 and 1982 to be 21, 24 and 25 respectively. During 1980 and 1981 a total of 61 Hawksbill nests were found within the Virgin Islands National Park on St John and a minimum of 80 nests (mainly Hawksbill) were found on Buck Island (Small, 1982). Boulon (in litt., 9 February 1986) reported moderately abundant nesting; Carr et al. (1982) reported occasional nesting throughout the US Virgin Islands; and Bacon (1981) considered nesting to be common.

Trends in nesting numbers Hawksbill nesting populations were believed to have been greatly depleted by a once burgeoning market for all sea turtle products, including eggs (Small, 1982). Boulon (in litt., 9 February 1986) considered the present day nesting population to be increasing.

Nesting season Nesting reported by Boulon (1984) occurred May-October on St Croix, June-November on St Thomas, and May/June-November/December on St John. Within the Virgin Islands National Park (St John), nesting in 1980 occurred early June-late December (Small, 1982). In 1980 and 1981, nesting within Buck Island Reef National Monument occurred early May-late December (Small, 1982).

Foraging sites Foraging sites were identified at Francis Bay, Maho Bay, Caheel Bay, Crux Bay, Brown Bay, Hawksnest Bay and Salt Pond Bay on St John and at Magen's Bay on St Thomas. Bacon (1981) reported foraging at Buck Island Reef. Carr et al. (1982) noted that coral reef and seagrass habitats were widespread and that Hawksbills were found throughout the area.

THREATS

Small (1982) considered the level of predation by mongooses to be such that the sea turtle nesting population at Buck Island was in jeopardy. Other threats came from human poaching, beach erosion and predation by dogs (Boulon, 1984); and from the destruction of nesting habitats by development that supported tourism and an ever-growing local population (Small, 1982).

EXPLOITATION

Commodity Boulon (in litt., 9 February 1986) reported that indigenous sea turtle populations were not harvested in the US Virgin Islands. Small (1982) did, however, report that sea turtle eggs were taken on nesting beaches on St Croix and Buck Island.

Hunting intensity Small (1982) reported the finding of seven nests on Buck Island in 1981 that had been poached by humans; six of these were found on one day and it was considered possible that many more than seven nests were robbed during the year.

Hunting methods See above.

Domestic trade There appears to be no domestic trade in sea turtles or their products.

International trade There is no reported trade involving sea turtles or their products to or from the US Virgin Islands. These Islands are covered by the USA's ratification of CITES (14 April 1974). Clarke (in litt., 26 August 1986) suspected some illegal trade between the British and US Virgin Islands.

RANCHING/HATCHERIES

Head-start projects involving Green Turtles and Hawksbills were in progress in the early 1980s (Boulon, unpublished).

US VIRGIN ISLANDS

LEGISLATION

Protection of Marine Turtles, nests and eggs, US Virgin Islands Legislation, No. 3330, 21 November 1972.

> It is prohibited to take, kill, possess, mutilate any species of sea turtle on the beaches, or to take or possess any turtle in the Territorial waters during the months of May through September inclusive.
> It is prohibited to import, trade, sell or in any way deal in young sea turtles, except under permit for display purposes. No person may take, possess, disturb, destroy, sell etc any sea turtle nest or eggs at any time.

The US Federal Endangered Species Act (q.v.) applies in the US Virgin Islands.

POPULATION Little information is available on sea turtles in Vanuatu. Both C. mydas and E. imbricata are reportedly common in Vanuatu, both species nest, and extensive reef and shallow-water habitat is available (McElroy and Alexander, 1979, cited in Pritchard, 1982).

Information collected by Dickinson (in litt., 8 November 1981) indicated that turtles can be encountered almost throughout the group, from Aneityum in the south, to the Banks group in the north. Among his 380 informants (college students), around 50 reported seeing fresh turtle nests over the period December 1980-February 1981. Nesting numbers are suspected to be relatively high; this is attributed to the lack of sustained fishing pressure (although it is locally intense), the sparse human population, and lack of coastal development.

According to McElroy and Alexander (1979, cited in Pritchard, 1982), the most important nesting area is around south Malekula, with significant C. mydas nesting and minor E. imbricata nesting at South West Bay (notably Lambobe beach). An estimated 40-120 turtles nest in this area annually. Turtles are said to be relatively common in the Maskelynes off southern Malekula, with regular nesting (species uncertain), especially on Seior and Laifond. The south-east of Epi and Torres Islands are other notable nesting areas. Both C. mydas and E. imbricata are said to nest from September to early January.

EXPLOITATION

Commodity Both species of turtle are exploited for meat and eggs. The use of shell is thought to be minimal (Pritchard, 1982).

Hunting intensity McElroy and Alexander (1979, cited in Pritchard, 1982) estimated that the annual catch of turtles in the Maskelynes Group, the principal turtle fishing area, amounted to 60-120, evenly split between C. mydas and E. imbricata. Eggs and nesting females were said to be taken whenever they were found. The hunting pressure was localised and never intense, and was not thought to have had much impact on the turtle population.

Hunting methods The majority of turtles are deliberately caught at sea; females are also captured on the beaches. The people of the Maskelynes are said to be the best fishermen in the country (Pritchard, 1982).

Historical trends Pritchard (1982) implied that turtle catches were likely to increase in line with the increase in human population levels, which currently were relatively low.

Domestic trade There is said to be very little trade in turtle products (Pritchard, 1982; Dickinson, 1981). Hawksbill shells are occasionally sold in the market at 5000-15 000 Vatu each (£29-£88), and a large Green Turtle shell was offered at 20 000 Vatu, equivalent to almost double the average monthly labourer's wage (Dickinson, 1981).

International trade Vanuatu is not a Party to CITES. The only record of trade in turtle products with Vanuatu in CITES Annual Reports was when the UK reported importing one carving of Cheloniidae from there in 1979. Customs reports were found to contain no reference to trade in turtle products with Vanuatu.

VANUATU

LEGISLATION

Arrêté Conjoint No. 7, 1974

It is an offence to keep any turtle alive, out of the water for more than 72 hours, to sell or export any stuffed or preserved turtle, to dig up or collect turtle eggs, or to kill turtles while on land, or to sell any turtle or turtle egg, whether live or dead. [It is not clear whether this Arrêté has been superseded.]

Fisheries Regulation 1983.

It is an offence to disturb, take, have in possession, sell or buy any turtle eggs and also to interfere with any turtle nest. Applies to all species.
The commercialisation of E. imbricata is prohibited i.e. offence to buy or sell any Hawksbill or its shell.

POPULATION: Chelonia mydas

Nesting sites Scattered nesting has been recorded on the mainland, in Falcon, Miranda and Sucre, with most confirmed sites apparently in the last-named; very sparse nesting occurs at Islas los Roques and unconfirmed nesting has been reported on Isla Cubagua (between the mainland and Isla Margarita) (Pritchard, 1980). However, nesting of some significance is confined to Aves Island (Pritchard, 1980; Pritchard and Trebbau, 1984). Aves is a small sandbar, some 520 m x 200 m in extent, somewhat hourglass-shaped, located almost 500 km north of the Venezuelan mainland at 15°40'N, 63°36'W (Pritchard, 1980).

Nesting numbers Nesting on the mainland and Islas los Roques is sparse, most observations being of scattered single tracks, or a very few nests. Numbers at Aves are variable between seasons and between nights within a season: for example, 21 nests on 27 July 1980 but none 30 June-9 July; Pritchard (1984b) cited an estimate of 750 nests on Aves in 1979, and provisionally estimated that 200-300 may nest in a season. See also Table 213. Figures supplied by Medina et al. (1987) indicate that from 1984 to 1987 between 240 and 500 turtles were recorded nesting each year. It is not certain whether this represents the total nesting for the whole island. They estimated that the total nesting population for Venezuela was 510-1410.

Trends in nesting numbers Pritchard and Trebbau (1984) stated that the Aves nesting colony had declined sharply in recent years and cited a sequence of estimates of nightly nesting to substantiate this view; see Table 213. These authors also cite a report by Dampier in the late 17th century that the species then nested in great abundance on "Isla Blanco" off the coast of Venezuela, presumed to be the same as Isla Blanquilla, where no significant nesting has been reported in recent years.

Table 213. Nesting emergences at Aves per night according to, in historical order, Pinchon (1967), Brownell and Guzman (1974) and Laiz Blanco (1979) (all cited in Pritchard and Trebbau, 1984).

Year	period	Nightly emergences
1947	one week	150-200
1972, 1973	peak season	mean 22
1979	season	mean 11

Nesting season Nesting on Aves occurs from June or July through to August (Pritchard, 1980). On the mainland and Los Roques peak nesting is May-September (Medina et al., 1987).

Foraging sites Females tagged on Aves have been recovered at various locations in the Caribbean, mainly in the east (see next section). Venezuelan waters, notably the Gulf of Venezuela and the central Venezuelan coast, include foraging grounds for the C. mydas population nesting at Tortuguero (Costa Rica) although this population most frequents feeding grounds in the western Caribbean, off Nicaragua, Panama and Colombia (Pritchard, 1980).

Migration As of 1982 (Carr, et al.), 19 of the females tagged on Aves have been recovered at sea, mostly in the Dominican Republic, also in the Lesser Antilles (Isla la Tortuga, Grenada, the Grenadines, Martinique, Guadeloupe), Isla Mujeres (Mexico), and Miskito Keys (Nicaragua). Turtles head-started at Los Roques are reported to have been recovered in Panama, Costa Rica, Belize, Jamaica and Brazil (Anon., 1987b).

POPULATION: *Eretmochelys imbricata*

Nesting sites Little nesting is known on the mainland, but it occurs widely in the islands, where it is recorded on Isla Margarita, Isla la Tortuga, possibly on Isla Blanquilla, and is best-documented in the Archipiélago los Roques (Pritchard and Trebbau, 1984). In the Los Roques group some 28 km of beach are available, distributed over 32 beaches on 25 islets; nesting is known on Cayo Sal, Cayo de Aqua, Bequeré, Selesqui, Carenero, Los Canquises, Sarqui, Espenqui and Isla Larga (Pritchard and Trebbau, 1984). Most known nesting islands are in the west of the Archipelago; those in the east have little beach but much mangrove (Pritchard, 1980). Medina et al. (1987) reported that mainland nesting occurred in the states of Falcon, Aracua and Anzoategui.

Nesting numbers Pritchard (1984b) suggests that the nesting in the Los Roques group (Table 214) could involve fewer than 20 mature females (it is not clear if this is per year or in total); no estimate can be given for numbers at La Tortuga or Blanquilla. If no greater numbers nest on other Venezuelan islands, the total nesting population would be very small. Medina et al. (1987) estimated that there were five beaches on which single *E. imbricata* nested, 50 on which fewer than ten nested and five with more than ten females, giving a minimum nesting population of 105 females and a maximum of 1005.

Table 214. Monthly nesting by *E. imbricata* in the Los Roques group, 1979 (unpublished data from the Fundacion Los Roques, cited by Pritchard, 1980).

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Nests	1	1	4	10	12	17	10	4	1

Trends in nesting numbers No long-term data on trends are available.

Nesting season Some nesting occurs between May and December, mostly in July-October, with a peak in September (see Table 214).

Foraging sites Little specific information is available. Immature *E. imbricata* have been seen around Aves Island (Brownell and Guzman, cited by Pritchard, 1980).

THREATS

All *C. mydas* eggs that were laid at Aves Island in the first half of 1979 were destroyed by the passage of Hurricane David on 29 August, which also washed away large volumes of sand and split the island in two (Pritchard, 1980). It appears likely that heavy exploitation of *C. mydas* nesting on Aves, mainly by fishermen from the Lesser Antilles (also of migrant *C. mydas*

foraging in Venezuelan waters), and of E. imbricata at Los Roques, mainly by local fishermen, has had an adverse impact on the species involved.

EXPLOITATION

Commodity The meat and eggs of C. mydas are consumed along the coasts of Venezuela, and its shell is sometimes used by artisans. E. imbricata is not eaten, but its eggs are, and it is frequently killed for its shell (Pritchard and Trebbau, 1984). There is said to be some medicinal use of oil and other parts of E. imbricata (Medina et al., 1987).

Hunting intensity In spite of legal protection, hunting of turtles still continues along the coasts and islands of Venezuela. Two of the main areas for hunting C. mydas are the Peninsula de Paraguana and Estado Sucre where they make an important contribution to the local economy. E. imbricata is killed particularly on Isla la Tortuga, where Pritchard found large quantities of bones in 1983, the shell reportedly having been sold in Isla Margarita. A total of 50 t of marine turtles were said to have been killed annually in the Archipiélago los Roques up to 1973, and egg predation on the islands was said to be intense, 39 out of 53 E. imbricata nests having been robbed (Pritchard and Trebbau, 1984). Turtles killed by Venezuelan fishermen have traditionally been used to supply the market in the Netherlands Antilles, and this trade still continued in Curaçao in 1986 (Sybesma, 1986). Medina et al. (1987) estimated, on the basis of five years' observations, that 468 C. mydas and 71 E. imbricata were killed each year in Venezuelan waters, the great majority around Isla Margarita.

Hunting methods Most turtles are caught in nets or by turning on the beaches, but there is an old report of the use of remoras at La Guaira in 1885. The coastal fishermen, when they found a fresh nest, used to lie in wait for females returning to lay 15 days later (Pritchard and Trebbau, 1984).

Historical trends The Green Turtles nesting on Isla Aves, because of its isolated position, have for long been harvested by fishermen from other Caribbean islands. Labat's (1725) description of Frenchmen spending four months fishing for Hawksbill and Green Turtles on the "Iles de la Tortille" was interpreted by Parsons (1962) as a possible reference to Isla Aves. Around 1960, two St Lucian sailing vessels used to take 50-60 turtles a trip from the island to Dominica, making about six trips a season. The total number of Green Turtles passing along this route was estimated to be 400 a year. Other turtles were taken directly to St Lucia, some destined for onward shipment to Europe (Parsons, 1962). In the 1970s, boats from St Lucia, Dominica and Martinique continued to make visits to the island, but the establishment of a permanent garrison is now thought to have put a stop to this (Pritchard and Trebbau, 1984). The Island of Blanquilla was the site of a turtle-curing station which sent jars of meat to the mainland at the turn of the century (Parsons, 1962).

Domestic trade Green Turtle meat was reported to be available in restaurants in Coro, Estado Falcon in 1983, and to be widely sold in Estado Sucre. In the 1960s, eggs sold for 50 centavos for three and meat was only 3 Bolivares a kg, about half the price of goat meat. The shell of C. mydas has occasionally been used by artisans in Margarita and eastern Venezuela (Pritchard and Trebbau, 1984). In 1987, eggs were Bs1-3 each and meat was Bs10-45 a kg. A whole C. mydas was said to be worth Bs700 (Medina et al., 1987).

VENEZUELA

International trade Venezuela acceded to CITES on 20 July 1976. CITES Annual Reports have recorded a total of six shells of C. mydas imported from Venezuela by the USA and Switzerland. Italy has consistently reported exporting leather items made from C. mydas skin to Venezuela: 38 handbags in 1983, 220 items in 1981 and 45 handbags in 1980. And the Cayman Islands reported exporting 20 lb (9 kg) of C. mydas oil to Venezuela in 1980.

Most of the international trade in turtle products has involved turtles removed from the offshore islands by visiting foreign ships, notably Dominica, St Lucia, Martinique and the Netherlands Antilles (see above). Traders supplying the Colombian artisan shell-carving industry are said to purchase tortoiseshell on Isla Margarita (Mast, 1986; Medina et al., 1987). Isla Margarita has the status of a freeport, and this may facilitate the covert export of Hawksbill shell.

The Customs reports consulted contain only sporadic reference to trade in tortoiseshell with Venezuela. In 1976, the Netherlands reported importing 1 t and Japan has only reported imports of bekko of 453 kg, 68 kg, 2447 kg and 171 kg in 1957, 1958, 1959 and 1973 respectively.

LEGISLATION

Resolution containing the Official List of Animals which may be hunted, 13 November 1970.

The following are considered game species by this Resolution: C. caretta, C. mydas, E. imbricata, L. olivacea, D. coriacea.

List of Animals which may not be hunted, 28 November 1979.

Establishes a permanent close season throughout the national territory of Venezuela in respect of the following game species. Permits to take listed animals can only be granted for scientific or wildlife management purposes: C. caretta, C. mydas, E. imbricata, L. olivacea, D. coriacea.

C. mydas also received additional protection with the establishment of Isla Aves as a Wildlife Refuge. Turtles also receive protection under various protected land designations.

HATCHERIES

The research station at Dos Mosquises, Los Roques, has had a programme for hatching and releasing C. mydas and E. imbricata since 1975. Eggs are obtained from Archipiélago los Roques and also Isla de Aves. Hatchlings are raised in tanks for 6-7 months before being released. A second hatchery for E. imbricata and C. caretta was opened in 1984 at the Marine Investigations Station at Mochima National Park on the mainland, using similar techniques to those employed at Los Roques (Anon., 1987b).

POPULATION: Chelonia mydas, Eretmochelys imbricata

According to Bourret (1941), both C. mydas and E. imbricata occurred all along the coast of the former French possessions in Indochina, which included Viet Nam, and at the time of his writing, were considered to be common. Nesting appears to have been mainly limited to the offshore islands, but very little detailed information is available. Hawksbills occurred at Quan Phu Quoc island, and apparently nested. The Poulo Wai group is the only other nest site specifically named in available literature (Bourret, 1941), but this seems likely to be identical to the Ko Way group, apparently within Kampuchean territory. Both C. mydas and E. imbricata appear to have nested at Poulo Wai, and eggs for the Hawksbill rearing operation near Ha Tien (Viet Nam) were taken from this site. The harvesting of eggs of E. imbricata was said to have resulted in significant population reduction in Cochin China as early as 1923, when the first protective legislation was introduced (Le Poulain, 1941). Hawksbill nesting in the islands off the west coast of the Cochin China region takes place in December-February.

It is not clear whether the fishery for C. mydas in the Con Son group (Poulo Condore) off the Mekong Delta mentioned by Parsons (1962) was based on nesting or foraging populations.

No information is available on recent population levels.

EXPLOITATION

Commodity Bourret (1941) said that C. mydas was hunted for meat and E. imbricata for its shell all along the coast of Cochin China.

Hunting intensity No information is available on recent levels of exploitation. Kakidachi and Uchida (1973) reported that E. imbricata were caught for stuffing in the Ha Tien area, possibly on feeding grounds among the nearby coral islands, and some proportion of these was exported to Singapore.

Hunting methods Presumably the methods of hunting described by Bourret (1941) for Kampuchea (i.e. nets, trawls and turning on the beaches) were also used in neighbouring Viet Nam.

Historical trends Parsons (1962) cited reports from the voyages of Dampier around the end of the 17th century that there was a flourishing industry extracting C. mydas oil in the Con Son group. Le Poulain (1941) estimated that the total Hawksbill shell production in the Province of Ha-Tien was about 200 kg a year. This presumably will have included the production from the farms. He said that the catches had declined considerably, and that this had caused the Governor to forbid the sale of turtle eggs in 1925.

Domestic trade Bourret (1941) reported that a tortoiseshell industry (he cites boxes and brushes among the products) existed in Tonkin, northern Viet Nam, based on shell sent from the Cochin China region of southern Viet Nam.

International trade Viet Nam is not a party to CITES. CITES Annual Reports contain only six records of trade in turtle products with Viet Nam: four bodies of E imbricata and one Cheloniidae leather item imported to the USA; one Cheloniidae shell imported to France, and a shipment of 7110

E. imbricata leather items imported to Italy in 1982. Italy does not have a reservation on this species.

Several countries' Customs reports have recorded importing tortoiseshell from Viet Nam. These are set out in Table 215. In recent years, Hong Kong has reported importing increasingly large quantities, but the Hong Kong Agriculture and Fisheries Department have confirmed that these do not relate to sea turtle shell (M.K. Cheung, in litt. to C. Huxley, 15 May 1985). It is likely that most of the shell is of freshwater turtles, which are widely fished in Viet Nam. Further evidence of the lack of trade in sea turtle shell is that Japan has never reported importing bekko from Viet Nam.

Table 215. Imports of raw tortoiseshell (kg) from Viet Nam reported in the Customs statistics of importing countries. 0 = no imports reported; - = Customs reports not available.

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Hong Kong	-	7	67	0	1854	0	0	0	0	7918	7132	13597	39384
S. Korea	-	0	600	0	0	0	0	0	0	0	0	0	0
Singapore	1289	30	0	0	0	0	-	-	-	-	-	-	-
Taiwan	-	0	1600	0	0	0	0	0	0	0	0	0	0

LEGISLATION

There is no information on recent legislation, but Le Poulain (1941) recorded that an Arrêté dated 21 April 1923 forbade the collection, sale or consumption of turtle eggs. A further Arrêté dated 25 April 1925 prohibited the capture of E. imbricata in the Gulf of Siam between 1 December and 30 April.

RANCHING

About a dozen farms for E. imbricata were said to be in operation in 1941 near the river mouth at Ha tien. The following description is from Le Poulain (1941).

Source of stock Eggs were collected from the beaches and kept in sand-filled wooden boxes which were lightly watered with sea water for an hour a day until they hatched. The young were sold to farmers for seven cents each at one month of age or one cent each for eggs.

Husbandry After hatching, young were placed in wooden basins filled with sea water which was changed three times a day. They were fed nothing for the first three days, and subsequently on chopped oysters and then chopped fish. When any illness was observed, the sick turtles were isolated in separate basins. Once they had reached a length of about 12-15 cm, they were taken to enclosures on the coast constructed from wattle. Each was roofed with thatch to shade the animals (said to produce blonder shell) and measured about 4 m x 2.5 m, with a depth, depending on the tide, of about 1.5 m. There were about 40-80 young turtles in each enclosure, and they consumed about 10 kg of fresh fish a day.

The turtles grew to 12 cm after about five months, 25 cm after 18 months, and were sold at three years old when they were about 34-40 cm long. They were worth about six piastres each. Mortality rates were in the order of 40-60%. Unlike the wild Hawksbill Turtles, which were often poisonous, those raised in farms were said to be delicious. Some two year old turtles were stuffed and sold as household ornaments.

WALLIS AND FUTUNA

No information on sea turtles is available. The islands are an Overseas Department of France, and are covered by the French approval of CITES (11 May 1978). CITES Annual Reports contain no reference to any trade with the islands.

No information available; suitable nesting habitat appears to be extensive.

International trade Western Sahara is not a Party to CITES. There is no record of any trade in sea turtles with Western Sahara recorded in the CITES Annual Reports.

LEGISLATION

No information.

POPULATION: Chelonia mydas

Nesting sites Although C. mydas is considered the most common sea turtle in Western Samoan waters, no confirmed nest sites are known (Hirth, 1971; Witzell, 1982).

Foraging sites Juvenile C. mydas can be seen in relatively large numbers around reefs in Western Samoa throughout the year, and tend to congregate around reef passages. Adults are seen mainly during December-February, when substantial numbers congregate near reef passages off Upolu, and feed on seagrasses in the area (Witzell, 1982).

Migration No turtles tagged in Western Samoa have been recovered and none tagged elsewhere have been found in Western Samoa; however Witzell (1982) suggests that the considerable juvenile foraging population in the country is derived from the Rose Atoll nesting site, in adjacent American Samoa.

POPULATION: Eretmochelys imbricata

Nesting sites A small population nests on three islets - Namu'a, Nu'utele and Nu'ulua - off the eastern tip of Upolu. Nesting beaches extend for 175 m, 950 m, and 350 m, respectively (Witzell and Banner, 1980).

Nesting numbers Witzell and Banner (1980, Fig. 5) indicate a maximum of around 25 tracks in both January and February 1972, with 0-10 in other months between September 1971 and August 1972. The annual breeding population is clearly very small indeed; Balazs (1982c) suggests the track counts indicate not more than 45 females nest annually.

Trends in nesting numbers According to Witzell and Banner (1980) the Western Samoan turtle population is now a small remnant of the former nesting population; there is now no mainland nesting although turtles were reported to have used mainland beaches in former times, and only Nu'ulua, by virtue of its relative inaccessibility, seems likely to support nesting in the future.

Nesting season Nesting occurs between September and July, with a peak in January-February (Witzell and Banner, 1980).

Foraging sites Witzell and Banner (1980) report that a portion of the hatchling and juvenile population is present on Samoan reefs throughout the year, and small E. imbricata of 4-40 cm length were frequently seen foraging in reef areas. Mature E. imbricata were also seen, but in numbers only in the nesting season.

THREATS

Extensive human predation on eggs and nesting females is said to have caused a marked decline in Western Samoan turtle populations, and in the late 1970s appeared likely to cause the total extirpation of the E. imbricata population in Western Samoa (Witzell and Banner, 1980).

EXPLOITATION

Commodity Both Green and Hawksbill Turtles are caught for food. They used to be an important food source but their present scarcity means that they are now mainly eaten by village chiefs on special occasions (Witzell and Banner, 1980).

Hunting intensity Human predation on E. imbricata is severe, and most nests which are not concealed by the Fisheries Division are collected (Witzell and Banner, 1980).

Hunting methods Most Green Turtles are caught at night while they are sleeping on the sea bed. A bright gas lamp is fixed to the bow of a canoe and, when a turtle is seen, a diver descends to spear it or catch it by hand. Usually only small turtles can be caught in this way. Nets are rarely used, although one community on Savai'i apparently owned one (Witzell, 1982). Nesting females are caught on the beaches and eggs are dug out (Witzell and Banner, 1980).

Historical trends The total population, and by inference the harvest, of E. imbricata is said to have declined considerably (Witzell and Banner, 1980).

Domestic trade Turtles are said to fetch a high price, and most are taken by bus to Apia where they are sold to affluent Samoans (Witzell, 1982). Two immature C. mydas (46-51 cm) were on sale in 1971 for $8.40 each. There was reported to be a moderate demand for Hawksbill shell jewellery in the shops in Apia, but it might have been imported material (Hirth, 1971). McCoy (in litt., 24 August 1988) reported that he had seen no Hawksbill shell jewellery on sale in 1987-88.

International trade Western Samoa is not a Party to CITES. The only records of trade in turtle products from Western Samoa contained in the CITES Annual Reports have been imports to the USA: three shells of C. mydas and one of E. imbricata between 1981 and 1983, and a single shipment of 24 unspecified E. imbricata in 1981 for commercial purposes.

The Customs reports consulted contain no reference to trade in raw tortoiseshell with Western Samoa. However, Fijian Customs reports record imports and exports of worked tortoiseshell to and from Western Samoa. The values of this trade are shown in Table 216. No trade was recorded from 1979 to 1984.

Table 216. Imports to and exports from Western Samoa of worked tortoiseshell reported in Fijian Customs Statistics. All values in Fijian $.

	1970	1971	1972	1973	1974	1975	1976	1977	1978	-	1985
Imports	0	0	39	0	118	222	54	722	355	-	0
Exports	370	104	523	79	0	0	0	0	160	-	334

WESTERN SAMOA

RANCHING

A hatchery for Hawksbills was set up in 1971 in the Aleipata district. Eggs were collected on outlying beaches and reburied in a protected facility. The hatchlings were reared for up to three months in concrete tanks before being tagged and released. Between 1973 and 1975, a total of 10 668 hatchlings were produced, with an overall hatching success of 66% (Balazs, 1982c). The hatchery was no longer functioning in 1982 (Johannes, 1986). It was suggested in 1971 that Hawksbills should be reared on a commercial basis for export to Japan, but these plans were abandoned because of disease, lack of a suitable cheap food supply and the need to continually change the sea water in the tanks (Balazs, 1982c).

LEGISLATION

In 1980, there was said to be no legal protection for sea turtles (Witzell and Banner, 1980).

POPULATION

Four sea turtle species, including *Chelonia mydas* and *Eretmochelys imbricata*, have been observed in waters of the Yemen Arab Republic (Walczak, 1979). Green Turtles are most commonly observed or accidentally caught, and account for most turtle remains washed up ashore; the Hawksbill is the second most abundant species (Walczak, 1979).

Sea turtles are widely distributed in YAR waters, including the Ras Katib area, reefs around Dicno Gulf in Kamaran Bay, Rhisa, and Kadaman Zaghir Island. A large group of turtles, possibly a mating aggregation, was reportedly encountered in Isa Bay one February (Walczak, 1979).

Most nesting appears to occur on the uninhabited low coral islands 3-30 km off shore; there may be important nest areas on Zugar and in the Hanish Archipelago, these being uninhabited volcanic islands in the south of the YAR coast (Walczak, 1979). Ross was informed (cited in Ross and Barwani, 1982) that turtles of three species nest "in large numbers" on Kamaran. A recent survey (L. Barratt, TMRU, *in litt.*, 16 April 1987) recorded no evidence of nesting, no individuals of *E. imbricata*, seven *C. mydas*, and many carapace remains; many offshore islands were not examined.

There is abundant coral reef habitat (where Hawksbills are often seen) around the island groups, and extensive seagrass pastures (suitable for Green Turtles) in the Ras Katib-Khor Katib area, in Isa Bay, and probably in Kamaran Bay and Khor Gulaifiga (Walczak, 1979).

EXPLOITATION

Commodity The meat of turtles, although eaten, is not in great demand in the YAR but, in contrast, the eggs are highly esteemed and are reputed to have aphrodisiac properties. Only female turtles are eaten and, in keeping with Muslim tradition, turtles found dead in fishing nets are not consumed (Walczak, 1979).

Hunting intensity Walczak (1979) reported that there was much evidence of nest disturbance for egg collection on some of the offshore islands.

International trade CITES Annual Reports reveal no trade in sea turtle products involving YAR.

LEGISLATION

Turtles are not protected in the YAR (Walczak, 1979).

POPULATION: Chelonia mydas

Nesting sites Sparse or moderate nesting occurs at many points along the coast, with dense nesting on at least three beaches east of Mukalla.

Perim Island, which lies in the Straits of Bal al Mandab, at the junction of the Red Sea and Gulf of Aden, is used mainly by Hawksbills (see below) but small numbers of old nests, presumed to be Green Turtles, were found in a survey in December 1966 (Hirth, 1968). On the mainland, there is dispersed low-level nesting along the approximately 175-km stretch of coast between Bab al Mandab and the Aden Peninsula, but apparently no sites of concentrated nesting. Conditions appear to be similar along the 500 km of coast extending from Aden east to Mukalla, with scattered beach records of nests, carapaces, and dead turtles presumed drowned in seines (Hirth, 1968).

More concentrated nesting is reported on five beaches all east of Mukalla: Shuhair, 40 km from Mukalla, 5.6 km long; Shihr, nearly 45 km from Mukalla, 0.4 km long; Musa, nearly 105 km from Mukalla, 0.24 km long; Sharma, 105 km from Mukalla, 1.8 km long; Ithmun, about 106 km from Mukalla, nearly 4.8 km long (Hirth, 1968).

There are an additional 400 km (approximately) of coastline, extending eastward from Ithmun to the border with the Dhofar region of Oman, that have not yet been surveyed for sea turtles. On topographic grounds, at least, there would seem to be a good chance that this area supports significant nesting.

Some nesting reportedly takes place on the north coast of Sokotra, probably by Green Turtles but possibly also by Hawksbills (Hirth, 1968).

Nesting numbers On present evidence, it appears that none of the beaches between Bab al Mandab and Mukalla supports nesting by more than a very few Green Turtles nightly at most.

In contrast, large numbers nest at the five beaches east of Mukalla (named above), most notably at Shuhair, Sharma and Ithmun (Hirth, 1968).

Shuhair: 25 females per km per night in November 1966; "large numbers" in December; about 9-12 per km in January 1967 (Hirth, 1968). Large numbers of females were taken from this beach in November-December 1966 and many hundreds had been taken in prevous years (Hirth and Carr, 1970). The turtles were taken as they emerged from the sea and taken to the exporters plant at Mukalla (Hirth, 1968).

Sharma: at least 30 females per km per night in November 1966; 9-12 per km in January; 5 on one night in March 1967; (Hirth, 1968); estimated 25 per night (apparently on the entire beach, not per km) in 4-8 July 1972 (Hirth and Hollingworth, 1973). Some nesting appears to occur throughout the year (Hirth and Hollingworth, 1973). "This is without any doubt one of the best nesting beaches remaining in the world" (Hirth and Carr, 1970).

Ithmun: few specific data, but stated to be similar to Sharma beach and thus "one of the most active" Green Turtle beaches in the world; about 40 turtles nested on one night in July 1972 (Hirth and Hollingworth, 1973).

Hirth (1968: p. 27) stressed that nesting density at these three beaches exceeded that at certain other major sites, such as Tortuguero (Costa Rica) and Ascension, and that at least 25-30 females could be seen per km of beach

on just about any night in November. Taking the lower of these figures, this means a possible total of around 140 per night on Shuhair, 45 per night on Sharma, and 120 on Ithmun, or over 300 a night in all. There may have been a further 25 a night on Shihr and Musa beaches. Evidence suggests that this population nests between September and the first week in December; if nesting occurs at maximum density throughout November, and at half that rate for a further 30 days, there may have been some 18 000 nests in all, laid by perhaps 6 000 females (if each nests three times). No information is available, however, on the proportion of beach emergences that result in nesting taking place.

A smaller contingent, evidently separate from the population nesting in November, nests in January-March. Based on Sharma beach data, where there are 15-20 turtles nightly in January instead of the 50 nightly in November, this population may be about one-third as large.

Ross and Barwani (1982) assessed Hirth's data in the light of nesting parameters of the Ras al Had C. mydas population in Oman, and estimated that some 10 000 females nested annually in PDRY.

Trends in nesting numbers No information is available to compare with the survey data collected by Hirth (1968) during the 1966-1967 north-east monsoon period, and by Hirth and Hollingworth (1973) during the 1972 south-west monsoon period. Therefore no trends in nesting numbers can be distinguished.

Nesting season It appears that year-round nesting occurs on at least Sharma beach (Hirth and Hollingworth, 1973), and this may apply to the entire coast. Different populations may be nesting at different times of year. The population found nesting in November, and inferred to nest between early September and the first week in December (i.e. around the start of the north-east monsoon, November-February), is thought to be separate from that nesting in January-March; and nesting recorded in July (within the south-west monsoon, April-September) may represent a further discrete nesting contingent.

Foraging sites The major feeding ground for Green Turtles is in the vicinity of Khor Umaira, some 80 km west of Aden. Seagrass pasture, composed primarily of Posidonia oceanica and Halodule uninervis, extends along the coast in this vicinity, but is concentrated in the Bay of Khor Umaira. The Bay, elliptical in plan and about 6 x 3 km in maximum extent, is almost completely landlocked by a long narrow sandspit. Maximum depth is about 10.5 m. Dugongs Dugong dugon have been seen feeding with turtles along the coast. Minor seagrass pastures exist between Ras Imran and Jabal Aziz (between Khor Umaira and Aden) and at Little Aden (Hirth, 1968).

Migration Hirth (1968) tagged 232 Green Turtles in 1966, all but ten of these on Musa and Sharma beaches, east of Mukalla. Of these, five have been recovered: one tagged on 17 November on Musa was recaptured on feeding grounds at Khor Umaira 39 days later on 26 December. The straight line distance between contacts is about 458 km, indicating a minimum speed of nearly 12 km a day. The remaining four turtles were recaptured off the east coast of Somalia; one at Chismayo in southern Somalia, two just north of Mogadiscio and two at Hordio just south of Cape Gardafui (the tip of the Horn of Africa). The timing of recaptures suggests that the turtles were travelling as part of a group (Hirth and Carr, 1970).

There are extensive seagrass pastures off the Somali coast as well as important nest beaches and significant exploitation (Travis, 1967); exploitation in Somalia will thus affect turtles nesting in Yemen (PDR) as well as turtles nesting locally.

POPULATION: Eretmochelys imbricata

Nesting sites Significant Hawksbill nesting has been recorded on Perim Island in the Straits of Bab al Mandab (the western extremity of mainland PDRY), and on Jabal Aziz Island, just off Ras Imran, around 50 km west of Aden. At least three beach zones exist on Perim: False Bay Beach, 365 m long; Shand Bay Beach, 360 m; Ras Sheikh Berkhud, a series of small scalloped beaches each c. 20 m long; and an unnamed beach midway between the last site and Obstruction Point. The Jabal Aziz nest site is a single 1.6 km beach facing Bandar Imran. There may also be some nesting on Sokotra. (Hirth, 1968).

Nesting numbers No new nests were seen on a survey of Jabal Aziz in October 1966, but moderate numbers were found in 1967: 30 January, 5 nests; 1 February, 17; 2 February, 8; 8 February, 16. On Perim, no nesting activity was observed 3-7 December, but there were signs of its occurrence in the "rather recent" past. Six old nests were seen on Shand Bay Beach and about 30 on Ras Sheikh Berkhud. Small numbers of Hawksbills were seen off shore. One female emerged to nest on 24 January.

The sparse data do not allow firm estimates of nesting numbers. The Jabal Aziz figures suggest a mean nightly emergence of about 11 females, if this is continued throughout January and February, there may be around 650 Hawksbill nests a season, with perhaps 200 females (if each nests three times). According to published evidence, Perim has considerably less nesting habitat and there is less direct evidence of nesting; if nesting takes place at half the Jabal Aziz rate, some 100 females may be involved a season. Ross and Barwani (1982) suggest an approximate total of 500 Hawksbills nesting annually in PDRY.

Nesting season Nest body pits found on Perim on 3-7 December 1966 suggested that "some rather recent" nesting had occurred. Local inhabitants reported that December and January are the main nesting months. Nesting has been directly recorded in late January and early February, but presence of two sets of ovidical eggs in a Jabal Aziz female that laid on 1 February suggests that laying continues until at least the end of February. Similar finding apply to Perim Island also (Hirth, 1968).

Migration No direct information. All Hawksbills observed on Jabal Aziz were heavily encrusted with barnacles (Hirth, 1968), possibly suggesting relatively sedentary habits.

EXPLOITATION

Commodity The coastal Arabs and the Bedu eat both the meat and eggs of C. mydas, but not on a large scale. Hirth (1968) reported that turtle was usually only consumed in villages where fish was not readily available. He indicated that the Kuria Muria Islands was the only locality where turtles were actively hunted for local consumption. In Socotra too, C. mydas was caught when the opportunity arises, the females being generally preferred. Out of 22 localities along the southern Yemen coast, Hirth (1968) reported

that turtle meat was consumed a' only 11 and eggs at seven, two of these last representing mainly the eggs of E. imbricata. The main incentive for turtle capture was the export market to Europe, which flourished in the 1960s. Hawksbill eggs were occasionally taken, particularly on the islands of Perim and Jabal Aziz (Hirth, 1968).

Hunting intensity The current intensity of hunting for turtles is not known, but the export to Europe is believed to have ceased, and so far as is known, the local demand has not increased. The British Embassy in Aden was informed by the Ministry for Fish Wealth that "the practice of exploiting turtles in South Yemen has been stopped" (A.S. Marshall in litt., 30 September, 1986).

Hunting methods Hirth (1968) reported that, in the east of the country, turtles were usually caught in shallow water, generally on the feeding grounds; but around Aden, most of the turtles sold were females, captured on the nesting beaches. They were turned on their backs as soon as they emerged from the water and loaded onto trucks the following morning. In the water, turtles were usually caught in nets or seines and were reported never to be harpooned. On Socotra, they were often caught by diving in shallow water or by using Remora. Eggs were seldom excavated from the nests, but oviducal eggs from slaughtered females were readily consumed. However thousands of eggs were thrown away at the slaughter house at Mukalla in 1966. Around Sharma, Bedu from the interior occasionally came down to the beach to collect turtles and eggs (Hirth, 1968).

Historical trends The main export trade in Green Turtle products took place in the 1960s, beginning in 1961. Hirth (1968) reported that the level of exports rose from 1963 to 1967, about 2000 turtles a year being exported, most of them females, all from the major rookeries in former Quaiti-State. Exports in 1969, 1970, 1971 and the first half of 1972 were respectively 2017, 4000, 0 and 200 (Hirth and Hollingworth, 1973). "A minimum of 400 to 700" (sic) were said to have been exported in 1973 (King, cited in Ross and Barwani, 1982). Hirth considered that the peak levels of exploitation were excessive, and recommended (1968) that the harvest be conducted only at sea and reduced to 1000 a year, of which no more than 500 should be females. This recommendation was reiterated in 1973 (Hirth and Hollingworth, 1973).

Domestic trade There is thought to be little local trade in turtle products. In 1967, turtle eggs sold for US$0.1 to US$0.3 per dozen in Aden, and a few poorly cured turtle shells were sold to tourists in the bazaars at about US$5 each (Hirth, 1968). In 1972, fishermen were being paid about US$6 for each turtle by the exporting company (Hirth and Hollingworth, 1973). Skerret (pers. comm., 1986) reported that there was no longer any tourist trade for turtles in the country.

International trade The early attempts to market meat products of C. mydas were made in 1961 in the Mukalla area by the Cooperative and Marketing Department. From 1963 to 1967, export was mainly, or latterly exclusively, in the hands of the Turtle Produce Co., a firm based in Kenya, who bought turtles from the fishermen (Hirth, 1968). In 1972, most of the export was handled by Caltex, a firm in Aden (Hirth and Hollingworth, 1973). The main export products were frozen or dried meat, calipee and calipash and a little oil. Almost all of it went to London and Northern Europe (Hirth, 1968). By 1972, the market was said to be in Holland, Germany and the USA, and oil was no longer being exported (Hirth and Hollingworth, 1973). The only indication of export of turtle products from

PDR Yemen in CITES Annual Reports is a single shipment of 300 kg of meat of <u>C. mydas</u> reported to have been imported by F.R. Germany in 1980.

LEGISLATION

In 1972 there was evidently no legal protection of sea turtles (Hirth and Hollingworth, 1973). It is not known whether any of the suggested protective measures have since been implemented.

RANCHING

Hirth (1968) recommended that an experimental turtle ranch be established in Khor Umaira Bay, which would involve fencing it off and releasing hatchlings within it to feed on the natural seagrass pastures. Further consideration showed that such a fence would require a capital outlay of at least US$800 000 and considerable maintenance costs. As a result, it was concluded that Khor Umaira would be unsuitable for a turtle ranch, but the recommendation for the establishment of an experimental ranch was reiterated "in the event a more practical site is located" (Hirth and Hollingworth, 1973). Not surprisingly, this suggestion does not appear to have been followed up.

No recent information is available. Brongersma (1982) cited an 1882 report of *C. mydas* at Banana and stated that nesting occurred; there appear to be no records of *E. imbricata*.

International trade Zaire acceded to CITES on 20 July 1976. There is no record of trade in turtle products with Zaire recorded in CITES Annual Reports.

LEGISLATION

Hunting Act, 28 May 1982.

The following species are protected. Their export can only be authorised if the exporter holds a certificate of lawful possession.

C. caretta
C. mydas
E. imbricata
D. coriacea

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